November 1975
Volume 19
Number 6

Mariners Weather Log

National Oceanic and Atmospheric Administration • Environmental Data Service

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November 1975
Volume 19 Number 6
Washington, D.C.

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Cover: The raging surf still dwarfs damaged residences along the Florida coast, between Panama City and Fort Walton, after Eloise has moved inland. For a description of Eloise, see page 379. Wide World Photo.

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Mariners Weather Log

RADIO FACSIMILE INFORMATION TO THE TROPICAL PACIFIC TUNA FLEET

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Tuna fishermen on the high-seas fishing grounds in the eastern tropical Pacific are wary of the tropical cyclones, the chubascos, and the severe local wind conditions, such as tehuantepecers, which typically occur in the area. Accurate information on the location and intensity of these storms was not always available to the fisherman when needed. In 1970, a program was developed at the National Marine Fisheries Service (NMFS), Southwest Fisheries Center (SWFC), La Jolla, Calif., to provide the tuna fleet with information on weather and fishing conditions on a regular basis, in exchange for environmental data from the fishing grounds. Such data are needed by NMFS scientists for studying the effects of environmental fluctuations on the distribution and availability of tropical tunas, and for developing fishery-forecasting techniques applicable to the management and harvesting of fishery resources. The data are also needed for preparing the fishery advisories; consequently, it is essential that fishermen report their observations in a timely manner.

One obstacle to the recruitment of tuna vessel captains into a real-time environmental observation program was a reluctance to reveal their position to competitors. This obstacle was removed by use of an encoding scheme for transmitting data messages. The Navy's Fleet Numerical Weather Central (FNWC), Monterey, Calif., cooperated in implementing the scheme, whereby each participating vessel is furnished with its own unique encoding chart. The decoding keys are stored in the FNWC computer, which processes the coded messages, feeds the data to the Navy's analysis and predictions programs, and routes the decoded observations back to the SWFC and also to the National Weather Service (NWS) Forecast Office, Redwood City, Calif.

Participating tuna vessels, which numbered more than 70 at the start of the 1975 fishing season, are expected to make and transmit marine surface weather observations once each day while on the fishing grounds. These include windspeed and direction, air temperature, sea-surface temperature, barometric pressure, weather, cloud cover, swell direction, and wave height. In addition, some 25 vessels are equipped with bathythermograph (XBT) systems with which subsurface temperatures can be measured and recorded. FNWC furnishes some of the XBT systems and the expendable probes through the SWFC to these vessels in exchange for data transmitted in the BATHY message format, which gives temperatures and depths down to 500 m.

In practice, tuna vessels at sea begin transmission of weather and BATHY messages about midafternoon each day, to NMFS-licensed radio station WWD, operated by the Scripps Institution of Oceanography and located at La Jolla, Calif. The messages are relayed via a data line through SWFC to the computer at FNWC, decoded and processed, and sent back to SWFC and to NWS, Redwood City, for use in preparing the daily analyses of wind and sea conditions. The processed BATHY data are also returned to SWFC on punched cards and in reconstructed computer plots of temperature-depth profiles, for research use.

At the time the program was conceived, no tuna vessels carried the special equipment necessary for radio facsimile (FAX) reception. The SWFC procured approximately 60 facsimile recorders from Government surplus and adapted them for use with shipboard radio communications equipment. These recorders were installed on selected San Diego-based tuna boats on an experimental basis beginning in 1971. They proved so valuable that more than a dozen other boats have since purchased their own facsimile recorders in order to receive the advisories.

Station WWD transmits two FAX advisory charts daily, beginning about 2300. One of the charts gives average windspeeds and directions expected during the next 24 hr, the locations and expected movements of

tropical cyclones, areas of squalls, and the configuration of the Intertropical Convergence Zone (ITCZ). Figure 1 shows the wind and weather advisory chart issued on July 16, 1974. The ITCZ was displaced north of its usual location at longitude 110°W (10° to 15°N in July), where tropical storm Francesca was approaching the tip of Baja California. Chubascos are shown near 10°N, 126°W, and 14°N, 117°W, while an incipient cyclonic circulation is indicated near 12°N, 95°W. Such disturbances can intensify suddenly; consequently, adequate forewarning can help boats avoid potentially hazardous situations.

Figure 2 shows the sea-state advisory chart for the same day. Swell directions are indicated by arrows, while predicted swell heights and wave heights are given by the plotted numbers. Sea and swell conditions are particularly important in purse seine operations because they affect deployment and retrieval of the net and safety of the crew.

In addition to the daily wind and weather and sea-state advisories, three charts depicting ocean temperatures are prepared and transmitted weekly by radio facsimile. These are a sea-surface temperature analysis (fig. 3), a mixed-layer depth analysis (fig. 4), and a sea-surface temperature difference analysis, which compares present conditions with those in the corresponding week of the previous year. These charts are prepared in order to provide to the fisherman environmental information which is deemed to be useful, and thereby enlist his cooperation in developing the potential application of such information to fishing strategy. For example, preliminary studies at the SWFC suggest that the highest frequency of successful sets on yellowfin tuna occurs with sea-surface temperatures of approximately 80° to 83°F (26.7° to 28.3°C). Knowing this, a tuna-boat captain can use the sea-surface temperature charts as an aid in determining where to fish. The mixed-layer depth charts might be used as an aid in judging the probable success of purse seine fishing operations. Shallow mixed-layer depths are believed to favor successful sets, particularly when the vertical temperature gradient just below the bottom of the mixed layer is strong, because the fish are less likely to escape the net if it requires that they swim down through the thermocline into cold water below. The temperature difference charts, along with a fisherman's past experience, can assist him in judging the significance to fishing success of changes in environmental conditions.

Much of the present knowledge of environmental-fishery relationships is qualitative and, to some extent, speculative. The research in progress at the SWFC, based on environmental observations and catch statistics from the fleet, is aimed at defining and quantifying these relationships to a degree that will benefit both the harvesting and management of tuna resources.

The FAX advisory charts are based on environmental observations and analyses from many sources, which include fishing vessels, merchant ships, weather satellites, the FNWC, the National Environmental Satellite Service (NESS), and the NWS. Nevertheless, the eastern tropical Pacific is affected by a chronic

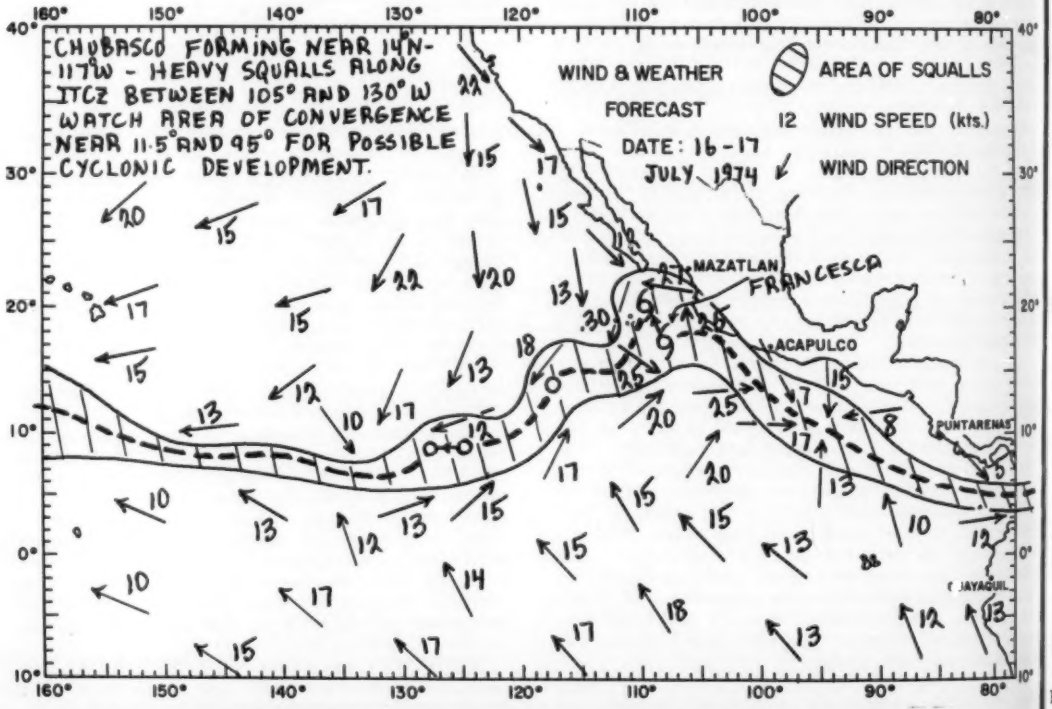
CHUBASCO FORMING NEAR 14N-117°W - HEAVY SQUALLS ALONG ITCZ BETWEEN 105° AND 130°W
WATCH AREA OF CONVERGENCE NEAR 11.5°AND 95° FOR POSSIBLE CYCLONIC DEVELOPMENT.
WIND & WEATHER FORECAST
DATE: 16-17 JULY 1974
AREA OF SQUALLS
12 WIND SPEED (kts.)
WIND DIRECTION
MAZATLAN
FRANCESCA
ACAPULCO
PUNTARENAS
160° 150° 140° 130° 120° 110° 100° 90° 80°
40° 30° 20° 10° 0°

Figure 1.--Wind and weather advisory chart transmitted by radio facsimile on July 16, 1974.

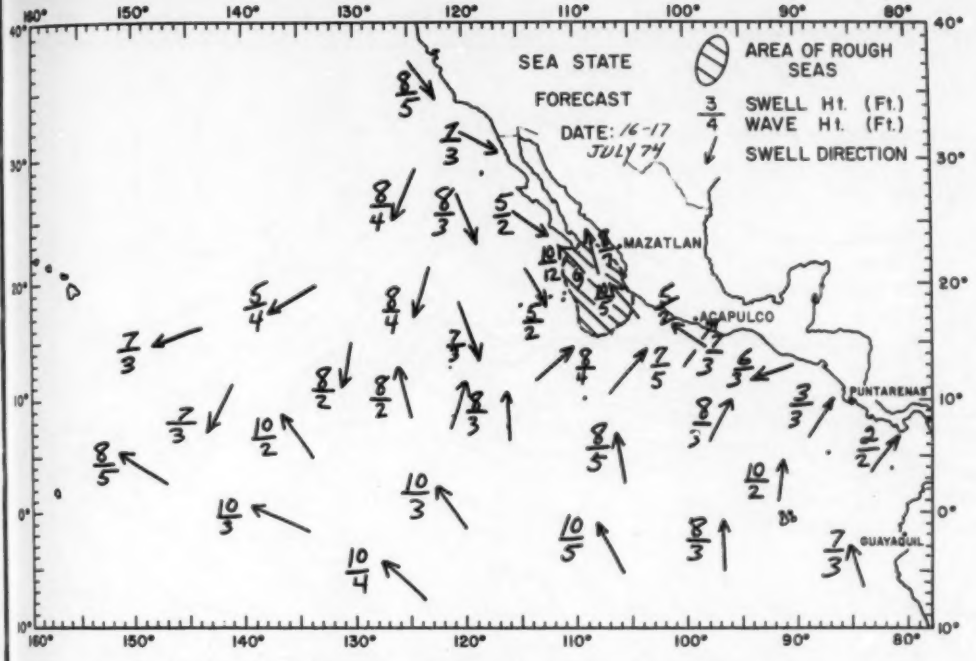

Figure 2.--Sea-state advisory chart transmitted by radio facsimile on July 16, 1974.

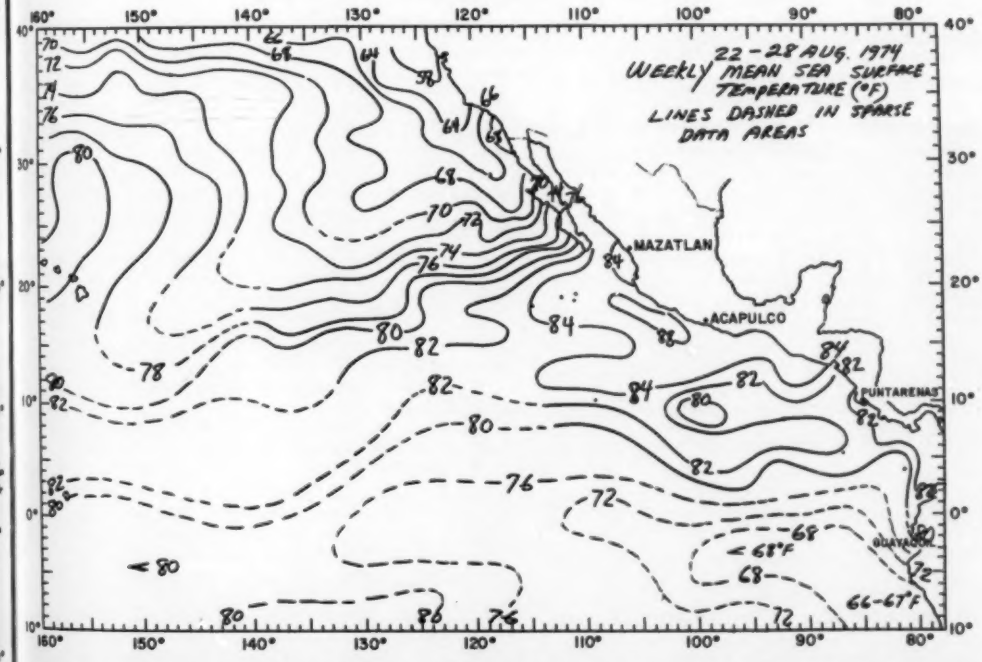

Figure 3.--Weekly sea-surface temperature chart for the period August 22-28, 1974. This chart was transmitted by radio facsimile on August 29, 1974.

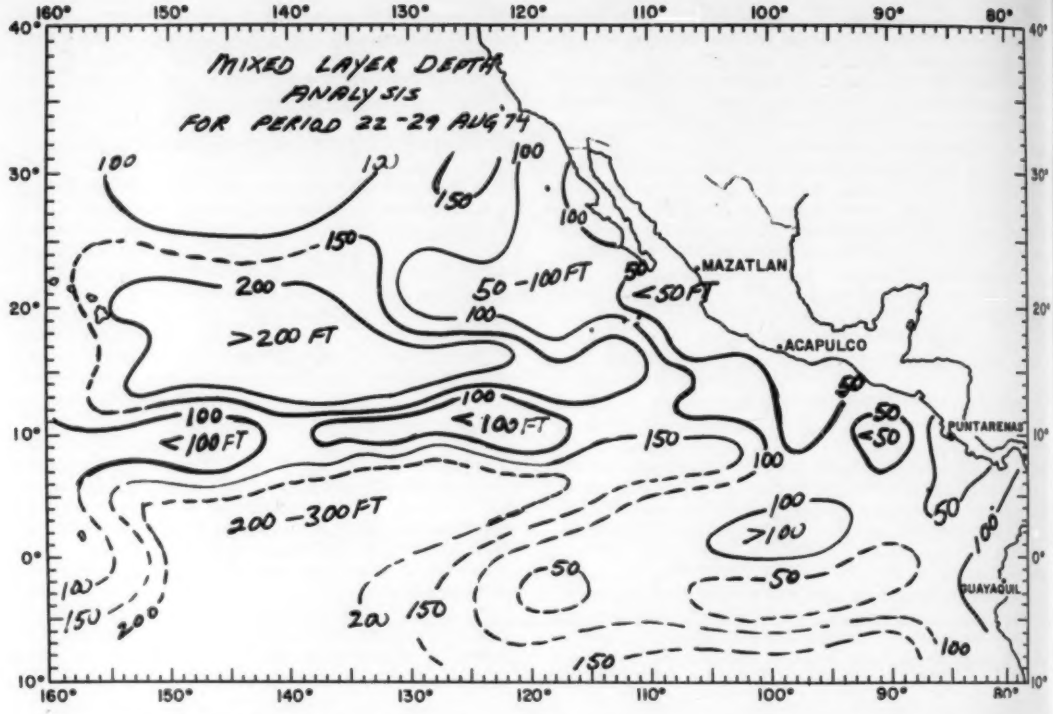

Figure 4.--Weekly mixed-layer depth chart for the period August 22-28, 1974. This chart was transmitted by radio facsimile on August 30, 1974.

deficiency of data and poses a difficult problem for marine analysts and forecasters. Consequently, in developing procedures for the preparation of wind, weather, and sea-state forecasts, emphasis was placed on the construction of a daily composite wind streamline analysis as the primary analysis tool. The streamline charts are not broadcast with the FAX charts, but enable the analyst to maintain careful day-to-day continuity, so that the course of tropical cyclone activity and other phenomena can be monitored with reasonable confidence, even when observations are sparse.

A reproduction of the streamline analysis for August 24, 1974, is shown in figure 5. The short arrows indicate observed wind directions and represent a sample of the observations reported by fishing vessels and merchant ships. The numbers plotted near the heads of the arrows give windspeed in knots. Three hurricanes (Ione, Kirsten, and Joyce) were active on this day, along with one tropical storm (Lorraine). The locations of these storms in the streamline analysis conform to those given for 1800 August 24, in the NWS San Francisco Eastern Pacific Hurricane Center Marine Advisories. The cyclonic circulation near 13°N, 101°W, detected off Costa Rica a few days earlier, became tropical storm Maggie on August 26.

The locations of the storm centers shown in figure 5 were all determined from weather satellite pictures. An excellent example is presented in figure 6, which shows hurricanes Ione (left) and Kirsten (right) at about 1750 on August 24. The picture was generated in the visible range with the very high resolution radiometer aboard the satellite NOAA-3 during a north-to-south overpass. A portion of the subpoint track (projection of the satellite's orbit onto the Earth's surface) is indicated by the dashed line in figure 5, which can be seen to pass nearly midway between the two hurricanes. On its preceding orbit, about 2 hr earlier, NOAA-3 passed over the area just east of Joyce and Lorraine, affording good fixes on those storms.

The availability of satellite imagery with comprehensive coverage of oceanic regions is obviously of tremendous value for monitoring conditions in the marine environment. Surface observations from fishing vessels and merchant ships are still essential, however, for determining surface wind, sea temperature, sea state, and other properties, and for providing "ground truth" to support continued development of remote-sensing technology.

Since August 1974, the daily wind and weather and sea-state advisory charts broadcast from station WWD have been prepared by the NWS San Francisco Weather Service Forecast Office (WSFO). The assumption by NWS of this service reflects a strengthening of the marine program at the San Francisco WSFO, which also prepares midlatitude analyses and prognoses for the North Pacific, for radio facsimile transmission from radio station NMC, San Francisco.[1] The NWS

[1]Radio facsimile transmission schedules of weather and sea conditions, along with transmission frequencies, are contained in the U.S. Department of Commerce publication "Worldwide Marine Weather Broadcasts," issued jointly by the National Weather Service and the Naval Weather Service Command.

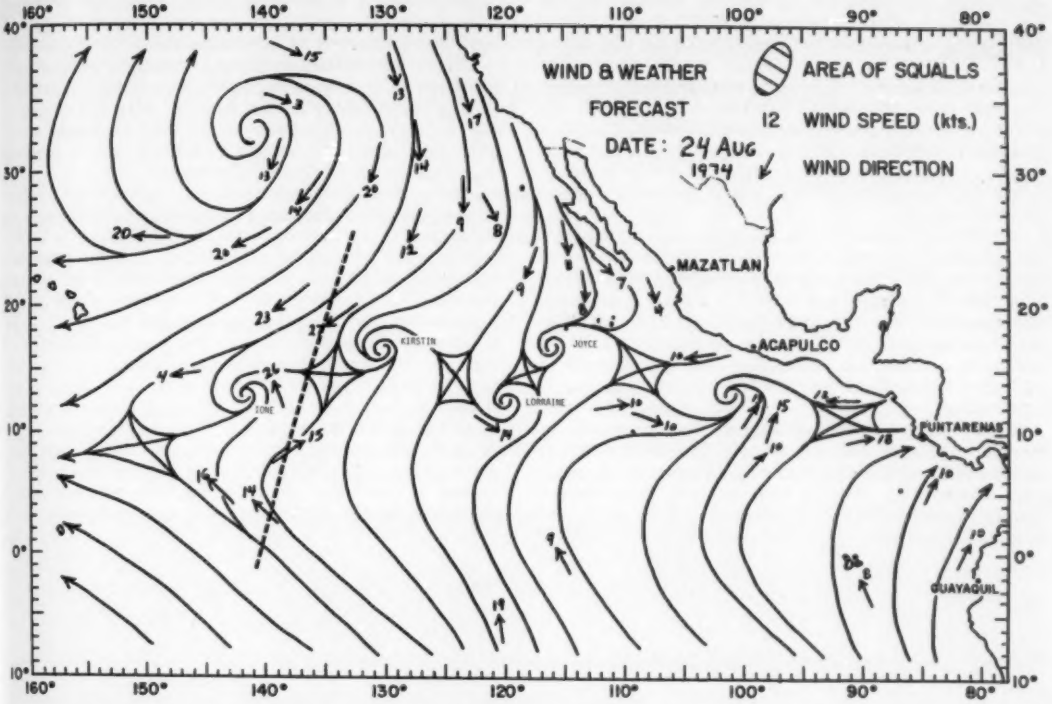

Figure 5. -- Streamline analysis of the wind field on August 24, 1974. The short arrows with numbers plotted near their heads represent observations of direction and speed, in knots, reported by fishing and merchant vessels. The heavy dashed line marks a portion of the subpoint track of NOAA-3 at the time the satellite picture in figure 6 was taken.

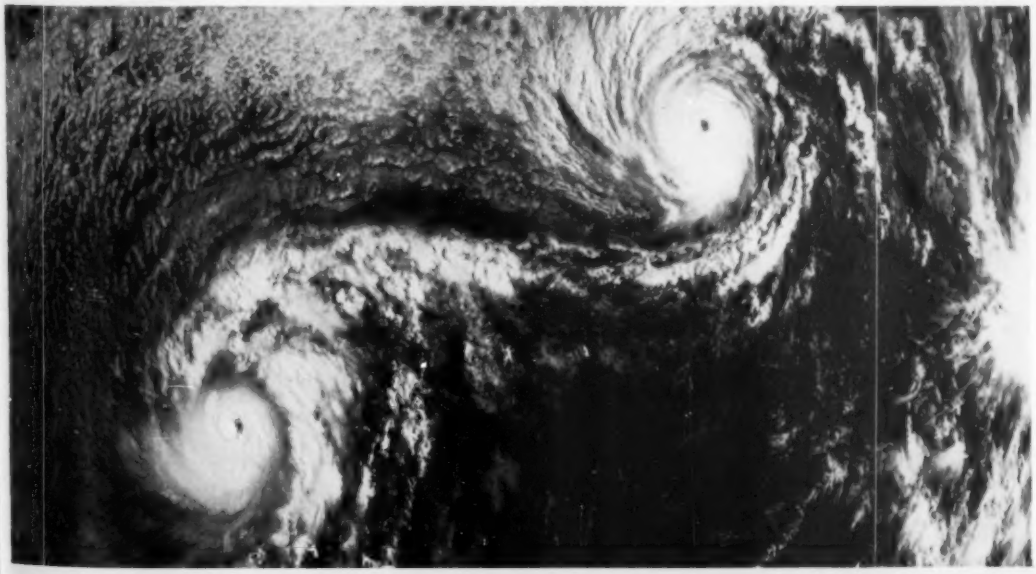

Figure 6. --Weather satellite picture taken with the very high resolution radiometer on NOAA-3, at about 1750 on August 24, 1974. The picture was received and processed at the San Francisco Satellite Service Field Station of the National Environmental Satellite Service.

FAX advisory charts for the eastern tropical Pacific are similar to those developed at SWFC (figs. 1 and 2), with some differences in format, such as the use of symbolic cloud images to denote squally areas, and streamlines instead of discrete wind arrows to denote the wind field, without an explicit delineation of the ITCZ. The NWS sea-state forecast charts also contain swell period in addition to swell height and wave height. The entry of NWS brought full 7-day coverage to the FAX advisory service, which formerly excluded weekends.

Marine forecasters at the San Francisco WSFO have the advantage of support from the NESS Satellite Field Service Station (SFSS), which is colocated with WSFO. The SFSS is equipped and staffed to receive, process, and interpret on a near real-time basis all satellite data, including output from the very high resolution radiometers (fig. 6). Thus, NWS will be assured of high-quality, up-to-date satellite imagery for use in forecasting conditions in the eastern tropical Pacific.

Radio facsimile transmission is also being used in the albacore tuna fishery investigations at the SWFC to send sea-surface temperature information to albacore fishermen. Weekly sea-surface temperature charts are prepared for the region 30° to 50°N, and seaward from the North American west coast to 140°W. Approximately 20 albacore fishing boats are equipped with facsimile recorders and are cooperating in an experimental effort to determine the value of sea temperature information to fishing strategy. The charts are broadcast from station WWD on Friday mornings during the albacore fishing season, May to October.

The FAX program was originated to obtain environmental data for fishery research and to provide fishermen with advisory information which might be of use in their fishing operations. Favorable reaction to the program stimulated increasing participation to the extent that communications are becoming a limiting factor in the amount of real-time data the program can yield. Such data, however, are certain to become more and more valuable as a consequence of the growing concern about and attention to the ocean's role in predicting climatic changes. The scope of global environmental monitoring essential to climate prediction is such that all systems of data collection must be utilized as fully as possible, including those involving cooperating fishing vessels. The continued development of data communications systems using satellites can be expected to lead to more efficient and reliable means of providing ships at sea with environmental analyses and forecasts in exchange for observational data.

WE OF NOAA ARE MAKING USE OF THIS SMALL AMOUNT OF SPACE TO EXTEND OUR THANKS TO ALL THE SHIPS' OFFICERS WHO ROUTINELY TAKE SHIPBOARD WEATHER OBSERVATIONS. TO US, THESE EXCELLENT OBSERVATIONS ARE PRICELESS. WE CERTAINLY DO APPRECIATE RECEIVING THEM ON A REGULAR BASIS.

Mariners Weather Log

THE WORLD OF TROPICAL CYCLONES

Dick DeAngelis
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Washington, D.C.

Columbus, on his second voyage to the New World, encountered a storm from the Tropics off the coast of Hispaniola. His fleet suffered no damage, and the experience proved valuable. During his fourth voyage, the fleet was threatened by a fully developed hurricane. Columbus read the signs of an approaching storm from the appearance of a southeasterly swell, the direction of the high cirrus clouds, and the hazy appearance of the atmosphere. He directed his fleet to shelter. Another Spanish flotilla paid no attention to his warning and sailed into the hurricane. They lost most of their ships, more than 500 men, and valuable treasure.

Ships are still lost in hurricanes (fig. 7) when a captain fails to heed a weather warning or lacks knowledge about tropical cyclones. The truly weatherwise

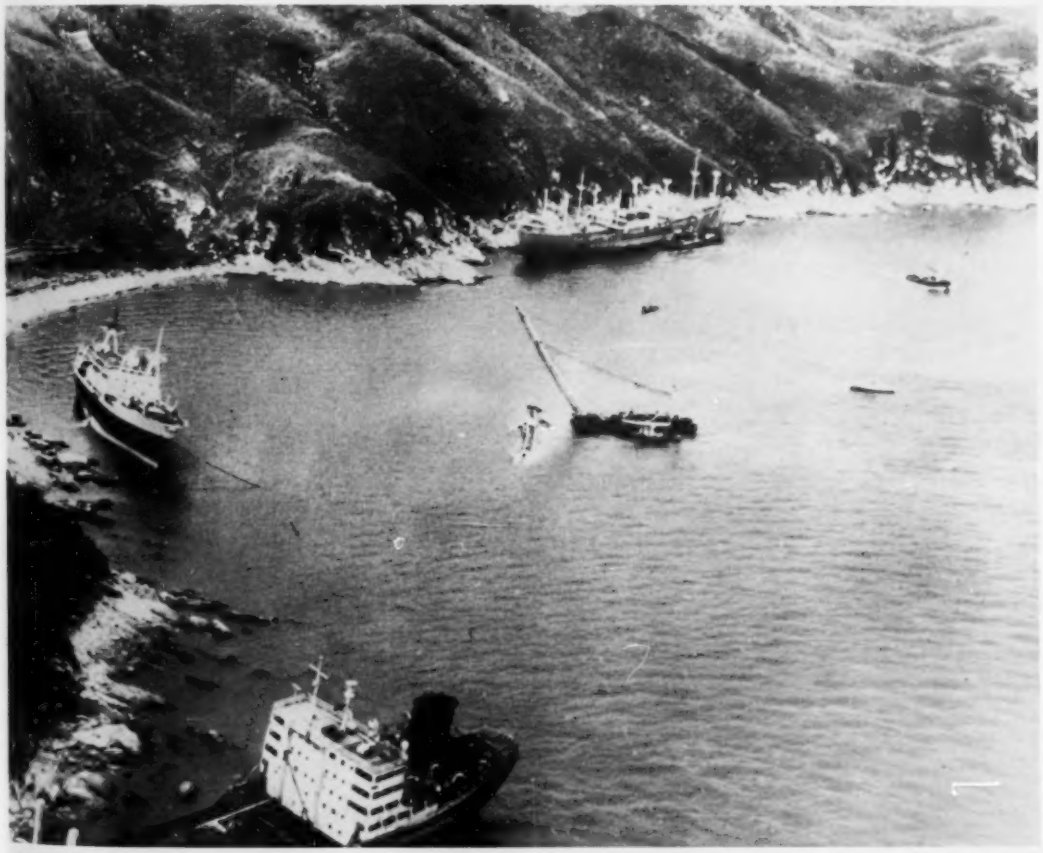


Figure 7.--Some 28 ships were sunk or driven aground during typhoon Rosa, in 1971. These were a few in Hong Kong harbor. Photo courtesy of the Royal Observatory Hong Kong.

seaman combines knowledge with caution.

"A hurricane is a tempest of the most extraordinary violence, forming a kind of imperfect vortex, towards the center of which the wind proceeds, successively and abruptly, from different points of the horizon." This quote, from Purdy's Memoir of the Atlantic, 7th Edition, is one of the early definitions of a tropical cyclone.

The evolution of tropical meteorology has brought a raft of names for describing and classifying the hurricane. "Tropical cyclone" is the broad term, while tropical disturbance, tropical depression, tropical storm, and hurricane are all included within this classification and are defined in table 1.

Table 1.--Tropical cyclone definitions

TROPICAL DISTURBANCE. A discrete system of apparently organized convection--generally 100 to 300 mi in diameter--originating in the Tropics or subtropics, having a nonfrontal migratory character, and having maintained its identity for 24 hr or more. It may or may not be associated with a detectable perturbation of the wind field. As such, it is the basic generic designation which, in successive stages of intensification, may be classified as a tropical wave, depression, storm, or hurricane.

TROPICAL WAVE. A trough or cyclonic curvature maximum in the trade-wind easterlies. The wave may reach maximum amplitude in the lower middle troposphere or may be the reflection of an upper troposphere cold-low or equatorward extension of a middle-latitude trough.

TROPICAL CYCLONE. A nonfrontal cyclone of synoptic scale developing over tropical or subtropical waters and having definite organized circulation.

(1) TROPICAL DEPRESSION. A tropical cyclone in which the maximum sustained wind (1-min mean) is 33 kn or less.

(2) TROPICAL STORM. A warm-core tropical cyclone in which the maximum sustained surface wind (1-min mean) ranges from 34 to 63 kn, inclusive.

(3) HURRICANE/TYPHOON. A warm-core tropical cyclone in which the maximum sustained surface wind (1-min mean) is 64 kn or greater.

An easterly wave moves across a tropical ocean--a common occurrence during the tropical cyclone season. However, this time ship reports indicate pressure in the region of the wave has fallen more than 5 mb in the past 24 hr. This is cause for concern, because in the Tropics pressure varies little; the diurnal pressure change is only about 3 mb. Satellite pictures indicate thickening middle and high clouds, squalls are reported ahead of the wave, and wind reports indicate a cyclonic circulation is forming. The former easterly wave--now classified a tropical disturbance--is moving westward at 10 kn under the canopy of a large high-pressure system aloft. Sea-surface temperatures in the vicinity are near 30°C.

Within 48 hr, winds increase to 25 kn near the center of a definite circulation (tropical depression), and the central pressure has dropped to near 1000 mb. Soon the circulation extends out to 100 mi and upward to 20,000 ft. Winds near the center increase to gale force, central pressure continues to fall, and towering cumulonimbus clouds shield a developing eye (tropical storm).

Satellite photographs soon reveal a tightly organized storm, and reconnaissance reports indicate maximum winds of 80 kn around a central pressure of about 980 mb (hurricane). A ship to the right (left in Southern Hemisphere) of the storm's center (looking toward the direction of storm movement) reports a 30-ft sea. The hurricane is fast maturing; it continues westward.

A few days later, the storm reaches its peak. The satellite snaps a textbook picture (fig. 8), as 120-kn winds roar around a 940-mb pressure center; hurricane-force winds extend 50 mi in all directions, and seas are reported up to 40 ft. There is no further deepening now, but the storm starts to expand. In 2 days, gales extend out to 200 mi, and hurricane winds out to 75 mi. Then the storm slows and begins to recurve; this turning marks the beginning of the end.

The hurricane accelerates, and, upon reaching the temperate latitudes, it begins to lose its tropical characteristics. The circulation continues to expand, but now cold air is intruding (cold air, cold water, dry air aloft, and land are the four catalysts that aid in the decay of a tropical cyclone). The warm core survives for a few more days before the transformation to a large extratropical low-pressure system is complete.

Not all tropical cyclones follow this idealized pattern. Most stumble in the early stages, some dissipate over land, and others remain potent for several weeks. Some are spawned in the Intertropical Convergence Zone (ITCZ), while others are generated by old polar troughs, but each, despite their differences, undergoes a life cycle similar to the ideal. They have many other similarities also.

Strong winds and low pressures are important, related features of the tropical cyclone. Strong winds exist in regions of tight-pressure gradients; the extremely low pressure in the center of a tropical cyclone is responsible for the rapid decrease in pressure over a short distance. In general, the lower the central pressure, the stronger the winds and the more intense the storm.

The lowest sea-level pressure ever recorded was 877 mb in typhoon Ida, on September 24, 1958. The observation was taken by a reconnaissance aircraft dropsonde some 750 mi east of Luzon, Philippines. This pressure was duplicated in typhoon Nora, on October 6, 1973.

During the severe Labor Day hurricane that struck the Florida Keys in 1935, a pressure of 892.3 mb--the lowest ever recorded in the United States--was observed. In hurricane Camille in 1969, a 905-mb pressure was measured by aircraft reconnaissance. Winds in these storms were estimated at 175 to 200 kn. Wind

Figure 8. -- Viewed from directly above during the 1972 season, typhoon Betty looks like a vast whirlpool. This high-resolution view shows the intimate details of the storm. Note the tops of thunderstorms embedded in the cloud shield. USAF Air Weather Service Photo.

instruments are usually incapable of measuring such extremes; if the instruments hold up, often their supporting structure gives way. During a 1927 typhoon, the SAPOEROEA recorded an 886.6-mb pressure--the lowest sea-level pressure reported by a ship. Another typhoon--Karen in November 1962--battered Guam with 150-kn sustained winds and 180-kn gusts. Wind gusts, which are usually 30 to 50 percent higher than sustained winds, have been measured at over 200 kn and add greatly to the destructive fury of the tropical cyclone. Many tropical cyclones that reach hurricane intensity develop winds of more than 90 kn sometime during their lives, but few develop winds of more than 130 kn.

Tropical cyclones have produced some of the world's heaviest rainfalls. While average amounts range from 6 to 10 in, totals near 100 in over a 4-day period have been observed. A 24-hr world's record of 73.62 in fell at Reunion Island during a tropical cyclone in 1952. Forward movement of the storm and land topography have a considerable influence on rainfall totals. Torrential rains can occur when a storm moves against a mountain range; this is common in the Philippines and Japan, where even weak tropical depressions produce considerable rainfall. A 24-hr total of 46 in was recorded in the Philippines during a typhoon in 1911. As hurricane Camille crossed southern Virginia's Blue Ridge Mountains, in August 1969, she dumped nearly 30 in of rain in about 8 hr, which triggered some of the most disastrous floods in the State's history (fig. 9).

Flooding is an extremely destructive byproduct of the tropical cyclone's torrential rains. Whether an area will be flooded depends on the physical characteristics of the drainage basin, rate and accumulation of precipitation, and river stages at the time the rains begin. When heavy rains fall over flat terrain, the countryside may lie underwater for a month or so, and while buildings, furnishings, and underground powerlines may be damaged, there are usually few fatalities. In mountainous or hill country, disastrous floods develop rapidly and can cause a great loss of life.

There have been occasional reports in tropical cyclones of waves greater than 40 ft in height, and numerous reports in the 30- to 40-ft category. However, in tropical cyclones, strong winds rarely persist for a sufficiently long time or over a large enough area to permit enormous wave heights to develop. The direction and speed of the wind changes more rapidly in tropical cyclones than in extratropical storms. Thus, the maximum duration and fetch length for any wind condition is often less in tropical cyclones than in extratropical storms of similar intensity, and the waves accompanying any given local wind conditions are generally not so high as those expected, with similar local wind conditions, in the high-latitude-type storms. In hurricane Camille, significant waves of 43 ft were recorded; an extreme wave height reached 72 ft.

Exceptional conditions may arise when waves of certain dimensions travel within the storm at a speed equal to the storm's speed, thus extending the duration and fetch of the wave and significantly increasing its height. This occurs most often to the right of the track (left in the Southern Hemisphere). Another condition that may give rise to exceptional wave heights is the intersection of waves from two or more distinct directions. This may lead to a zone of confused seas in which the heights of some waves will equal the sum

Figure 9.--The James River, filled with Camille's rains, overflows into Scottsville, Va. Wide World Photo.

in each individual wave train. This process can occur in any quadrant of the storm, and so it should not be assumed that the highest waves will always be encountered to the right of the storm track (left in Southern Hemisphere).

When these waves move beyond the influence of the generating winds, they become swell. They are recognized by their smooth, undulating form, in contrast to the steep, ragged crests of the wind waves. This swell, particularly that generated on the right side of the storm, can travel a thousand miles or more and may produce tides 3 or 4 ft above normal along several hundred miles of coastline.

When a tropical cyclone moves close to a coast, wind often causes a rapid rise in water level, and along with the falling pressure may produce a storm surge. This surge is usually confined to the right (left in Southern Hemisphere) of the storm center and to a relatively small section of the coastline. It most often occurs with the approach of the storm, but in some cases, where a surge moves into a long channel, the effect may be delayed. Occasionally, the greatest rise in water is observed on the opposite side of the track, when northerly winds funnel into a partially landlocked harbor. The surge could be 3 ft or less, or up to 20 ft or more, depending on the combination of all the factors involved.

There have been reports of a "hurricane wave," described as a "wall of water," which moves rapidly toward the coastline. Authenticated cases are rare, but some of the world's greatest natural disasters have occurred as a result of this wave, which may be just a rapidly rising and abnormally high storm surge. In India, such a disaster occurred in 1876, between Calcutta and Chittagong, and drowned more than 100,000 persons.

There have been many instances of tornadoes occurring within the circulation of tropical cyclones. Most of these have been associated with tropical cyclones of the North Atlantic Ocean and have occurred in the West Indies and along the Gulf and Atlantic coasts of the United States. They are usually observed in the forward semicircle or along the advancing periphery of the storm. These tornadoes are usually short-lived and less intense than those that occur in the midwestern United States.

Tropical cyclones roam most of the tropical seas, although none have been observed in the South Atlantic, or in the South Pacific east of 140°W. They are known by different names the world over, but they form in much the same way and often during the same seasons. Figure 10 is a worldwide presentation of areas affected by tropical cyclones, their frequencies, and season. Figure 11 shows the average tropical cyclone paths in these regions, while table 2 gives monthly and annual frequencies. The information in the figures and the table was obtained from the U.S. Navy's Mariners Worldwide Climatic Guide to Tropical Storms at Sea, by Crutcher and Quayle.

Table 2.--Monthly and annual average number of storms per year for each major basin (from U.S. Navy's Mariners Worldwide Climatic Guide to Tropical Storms at Sea)

BASIN AND STAGE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
NORTH ATLANTIC													
TROPICAL STORMS	*	*	*	*	0.1	0.4	0.3	1.0	1.5	1.2	0.4	*	4.2
HURRICANES	*	*	*	*	*	0.3	0.4	1.5	2.7	1.3	0.3	*	5.2
TROPICAL STORMS AND HURRICANES	*	*	*	*	*0.2*	*0.7*	*0.8*	*2.5*	*4.3*	*2.5*	*0.7*	*0.1*	*9.4*
EASTERN NORTH PACIFIC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
TROPICAL STORMS	*	*	*	*	*	1.5	2.8	2.3	2.3	1.2	0.3	*	9.3
HURRICANES	*	*	*	*	0.3	0.6	0.9	2.0	1.8	1.0	*	*	5.8
TROPICAL STORMS AND HURRICANES	*	*	*	*	*0.3*	*2.0*	*3.6*	*4.5*	*4.1*	*2.2*	*0.3*	*	*15.2*
WESTERN NORTH PACIFIC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
TROPICAL STORMS	0.2	0.3	0.3	0.2	0.4	0.5	1.2	1.8	1.5	1.0	0.8	0.6	7.5
TYPHOONS	0.3	0.2	0.2	0.7	0.9	1.2	2.7	4.0	4.1	3.3	2.1	0.7	17.8
TROPICAL STORMS AND TYPHOONS	*0.4*	*0.4*	*0.5*	*0.9*	*1.3*	*1.8*	*3.9*	*5.8*	*5.6*	*4.3*	*2.9*	*1.3*	*25.3*
SOUTHWEST PACIFIC AND AUSTRALIAN AREA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
TROPICAL STORMS	2.7	2.8	2.4	1.3	0.3	0.2	*	*	*	0.1	0.4	1.5	10.9
HURRICANES	0.7	1.1	1.3	0.3	*	*	0.1	0.1	*	*	0.3	0.5	3.8
TROPICAL STORMS AND HURRICANES	*3.4*	*4.1*	*3.7*	*1.7*	*0.3*	*0.2*	*0.1*	*0.1*	*	*0.1*	*0.7*	*2.0*	*14.8*
SOUTHWEST INDIAN OCEAN	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
TROPICAL STORMS	2.0	2.2	1.7	0.6	0.2	*	*	*	*	0.3	0.3	0.8	7.4
HURRICANES	1.3	1.1	0.8	0.4	*	*	*	*	*	*	*	0.5	3.8
TROPICAL STORMS AND HURRICANES	*3.2*	*3.3*	*2.5*	*1.1*	*0.2*	*	*	*	*	*0.3*	*0.4*	*1.4*	*11.2*
NORTH INDIAN OCEAN	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
TROPICAL STORMS	0.1	*	*	0.1	0.3	0.5	0.5	0.4	0.4	0.6	0.5	0.3	3.5
CYCLONES [1]	*	*	*	0.1	0.5	0.2	0.1	*	0.1	0.4	0.8	0.2	2.2
TROPICAL STORMS AND CYCLONES [1]	*0.1*	*	*0.1*	*0.3*	*0.7*	*0.7*	*0.6*	*0.4*	*0.5*	*1.0*	*1.1*	*0.5*	*5.7*

* Less than .05 Monthly values cannot be combined because single storms overlapping two months were counted once in each month and once in the annual.

[1] Winds ≥ 48 Kts.

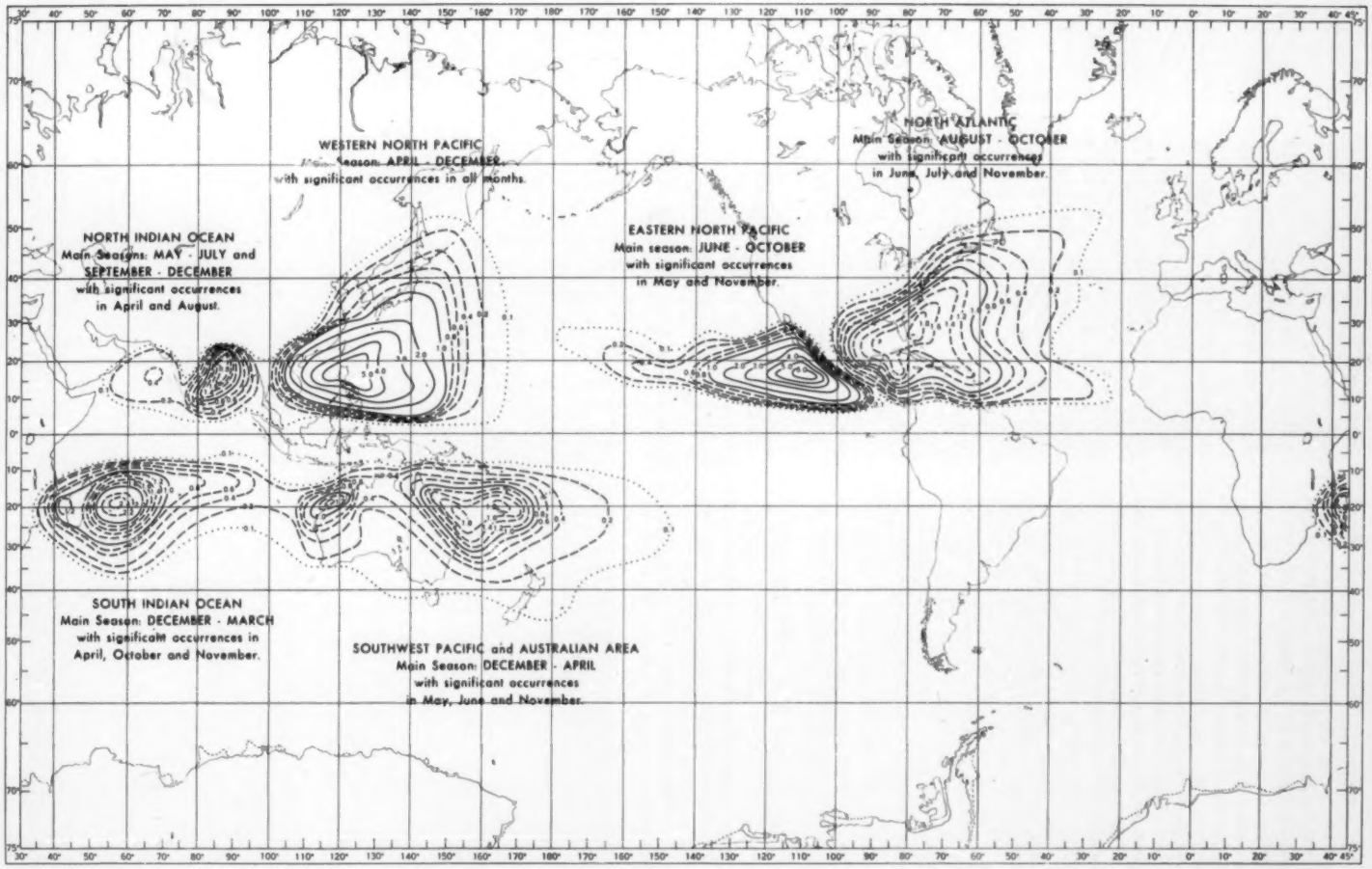

WESTERN NORTH PACIFIC
Main Season: APRIL - DECEMBER
with significant occurrences in all months.
NORTH ATLANTIC
Main Season: AUGUST - OCTOBER
with significant occurrences
in June, July and November.
NORTH INDIAN OCEAN
Main Seasons: MAY - JULY and
SEPTEMBER - DECEMBER
with significant occurrences
in April and August.
EASTERN NORTH PACIFIC
Main season: JUNE - OCTOBER
with significant occurrences
in May and November.
SOUTH INDIAN OCEAN
Main Season: DECEMBER - MARCH
with significant occurrences in
April, October and November.
SOUTHWEST PACIFIC and AUSTRALIAN AREA
Main Season: DECEMBER - APRIL
with significant occurrences
in May, June and November.

Figure 10.--The average number of tropical cyclones per 5° square per year has been analyzed for this figure. The main season for intense tropical storm activity is also shown for each major basin. From U.S. Navy's Mariners Worldwide Climatic Guide to Tropical Storms at Sea.

Sea.

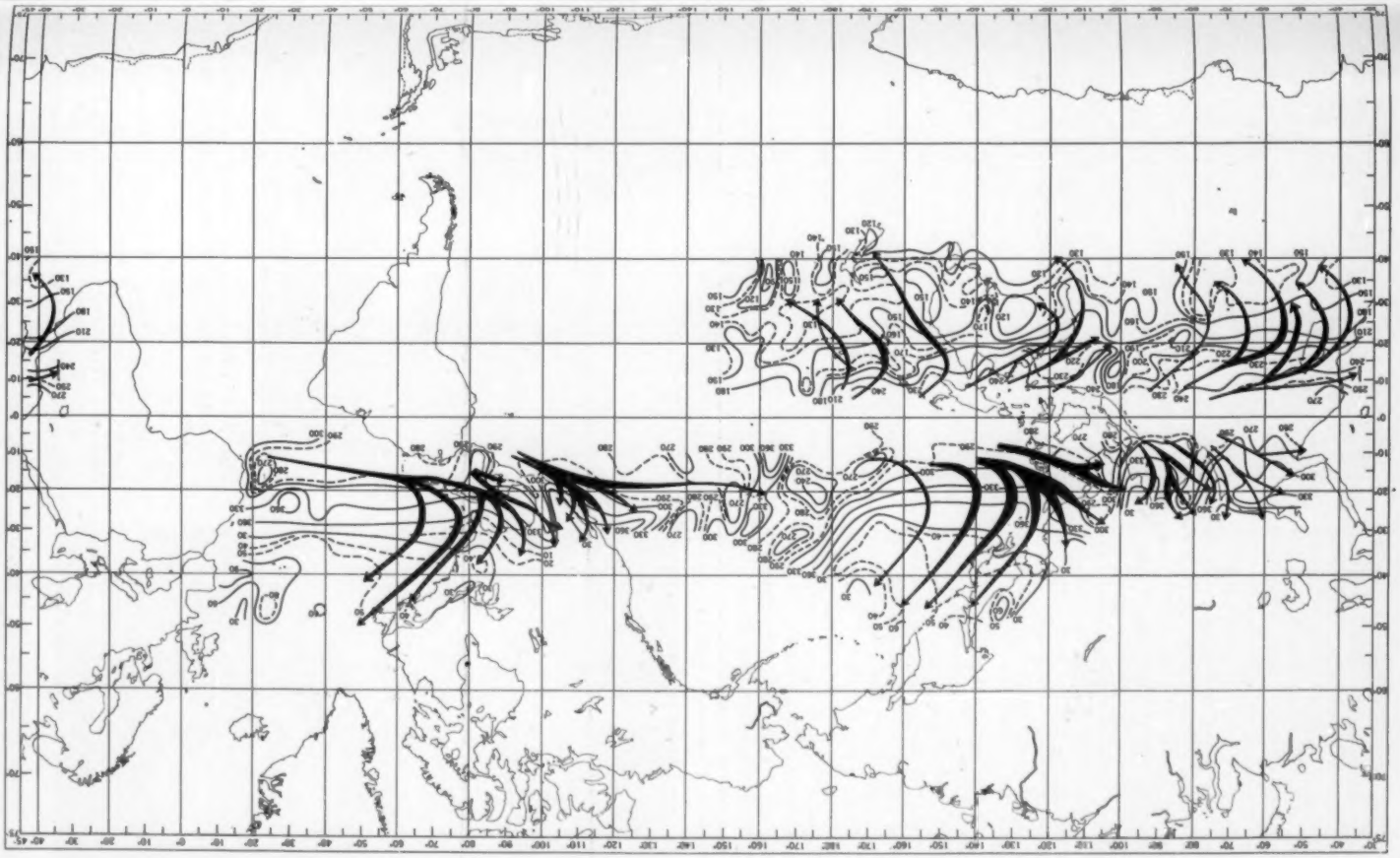


Figure 11.--Preferred storm tracks for tropical storms are represented by black arrows. The width of the arrow indicates the approximate frequency of storms; the wider the arrow, the higher the frequency. Isolines on the base map show the resultant direction toward which storms moved (Isogons). Data for the entire year have been summarized for this figure. From U.S. Navy's Mariners Worldwide Climatic Guide to Tropical Storms at Sea.

North Atlantic Ocean.--Tropical cyclones can affect the North Atlantic in any month. However, they are mostly a threat south of about 35°N, from June through November; August, September, and October are the heart of the season. About 9 or 10 tropical cyclones (tropical storms and hurricanes) form each season; 5 or 6 reach hurricane intensity (winds $\geq$ 64 kn). A few hurricanes have generated winds estimated as high as 200 kn. Early- and late-season storms usually develop west of 50°W, while during August and September, this spawning ground stretches to the Cape Verde Islands. These storms most often move westward or west-northwestward at speeds of less than 15 kn in the lower latitudes. Once into the northern Caribbean or Greater Antilles regions, they will usually either move toward the Gulf fo Mexico or recurve and accelerate in the North Atlantic. Some will recurve after reaching the Gulf, while others will continue westward to landfall.

Eastern North Pacific Ocean.--In this region, which extends from the Mexican-Central American coast to the international dateline, the season runs from June through October, although a storm could form in any month. An average of 15 tropical cyclones form each year, with about 6 reaching hurricane strength. The most intense storms are often the early- and late-season ones; these form close to the coast and far south. Midseason storms form anywhere in a wide band from the Mexican-Central American coast to the Hawaiian Islands (fig. 12). August and September are the heart of the season. These storms differ from their east coast counterparts in that they are usually smaller in size; however, they can be just as intense.

Figure 12.--Jewel develops as she churns westward in the eastern Pacific, on August 25, 1975.

Western North Pacific Ocean.--More tropical cyclones form in the tropical western North Pacific than anywhere else in the world. More than 25 develop each year, and about 18 become typhoons (hurricanes). These typhoons are the largest, most intense tropical cyclones in the world. Each year an average of five generate maximum winds over 130 kn. Circulations covering more than 600 mi in diameter are not uncommon (fig. 13). Most of these storms develop east of the Philippines, and move across the Pacific toward the Philippines, Japan, and China; a few storms form in the South China Sea. The season extends from April through December; however, tropical cyclones are more common in the off-season months in this area than anywhere else. The peak of the season is July through October, when nearly 70 percent of all typhoons develop. There is a noticeable seasonal shift in storm tracks in this region. From July through September, storms move north of the Philippines and recurve, while early- and late-season typhoons (called baguios by Philippinos) move on a more westerly track through the Philippines before recurving.

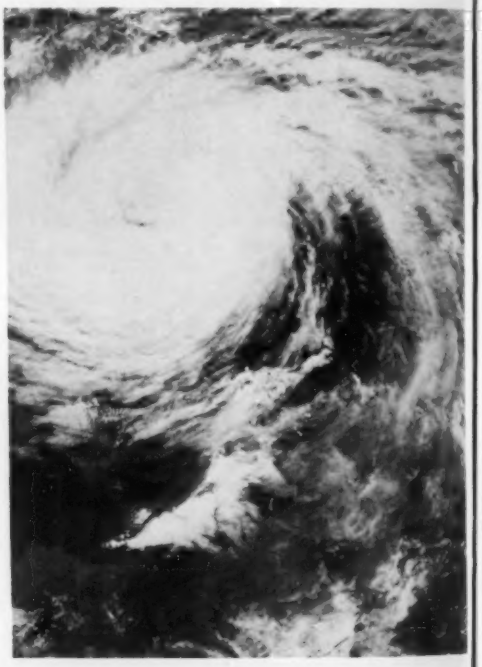


Figure 13.--The huge circulation of typhoon Ruth blankets Luzon and most of the Philippines, in October 1973.

North Indian Seas.--Tropical cyclones develop, in the Bay of Bengal and Arabian Sea, during the spring and fall. Tropical cyclones in this area form between 8° and 15°N, except from June through September, when the little activity that does occur is confined north of about 15°N. These storms are usually short-lived and weak; however, winds of 130 kn have been encountered. They often develop as perturbations a-

long the ITCZ, and this inhibits summertime development since the ITCZ is usually over land during this monsoon season. However, it is sometimes displaced southward, and when this occurs, storms will form over the monsoon-flooded plains of Bengal. On the average, 6 cyclonic storms (tropical storms and hurricanes) form each year, but another 10 tropical depressions never go beyond that stage. About two storms each year generate winds equal to or greater than 48 kn (severe cyclonic storm). Four times as many storms form in the Bay of Bengal as in the Arabian Sea; however, it is not unusual for a storm to move across southern India and reintensify in the Arabian Sea. This is particularly true during October--the heart of the tropical cylcone season. It is also during this period that torrential rains from these storms dumped over already rain-soaked areas cause disastrous floods.

In the Southern Hemisphere, where the circulation around tropical cyclones is clockwise, there is one broad area of tropical cyclone activity which is divided by Australia into two geographic regions--the South Indian Ocean and the western South Pacific.

South Indian Ocean.--Over the waters west of 100°E to the east African coast, an average of 11 tropical cyclones form each season, and about 4 reach hurricane intensity. The season runs from December through March, although it is possible for a storm to form in any month. Tropical cyclones in this region usually form south of 10°S. The latitude of recurvature usually migrates from about 20°S in January to around 15°S in April. After crossing 30°S, these storms sometimes become intense extratropical lows.

Southwest Pacific, Australia Region.--These tropical waters, extending from 100°E to east of Tahiti, spawn an annual average of 15 tropical cyclones, 4 of which reach hurricane intensity. The season extends from about December through April, although storms can form in any month. Activity is widespread in January and February, and it is in these months that tropical cyclones are most likely to affect Fiji, Samoa, and the other eastern islands.

Tropical cyclones usually form in the waters from 105°E to 160°W, between 5° and 20°S. Storms affecting northern and western Australia often develop in the Timor or Arafura Sea, while those that affect the east coast form in the Coral Sea. These storms are often small, but can develop winds in excess of 130 kn. New Zealand is sometimes the target for decaying Coral Sea storms; occasionally, it is clobbered by an intense hurricane or its extratropical remnants. In general, tropical cyclones in this region move southwestward and then recurve southeastward.

From the time of Columbus to the present, mariners and meteorologists have labored to understand the world of tropical cyclones. The years of patient observing are now paying off in better forecasts and more detailed climatology. In future issues, we plan to explore the tropical cyclones that affect each region. The data for these summaries will come from the most comprehensive tropical cyclone guide ever published--the U.S. Navy's Mariners Worldwide Climatic Guide to Tropical Storms at Sea.

THE MARINERS WEATHER LOG WELCOMES ARTICLES AND LETTERS FROM MARINERS RELATING TO METEOROLOGY AND OCEANOGRAPHY, INCLUDING THEIR EFFECTS ON SHIP OPERATIONS.

SAHARA DUST OVER THE ATLANTIC

B. Max Mayfield
National Environmental Satellite Service, NOAA
Miami, Fla.

Man's knowledge of the atmosphere over data-sparse oceanic areas has increased dramatically with the application of meteorological satellites. Today's continuous flow of pictures from improved geostationary satellites permits scientists to witness the evolution of weather systems over the Atlantic and some of the Pacific. The 2-mi-resolution visible spectrum pictures included in this article were received at the Miami Satellite Field Services Station in real time from the National Environmental Satellite Service's first Synchronous Meteorological Satellite (SMS-1).

Figure 14 was taken at 1700 June 26, 1975, and shows a milky-looking pattern over the Atlantic between about 11° and 28°N, from the African coast west-

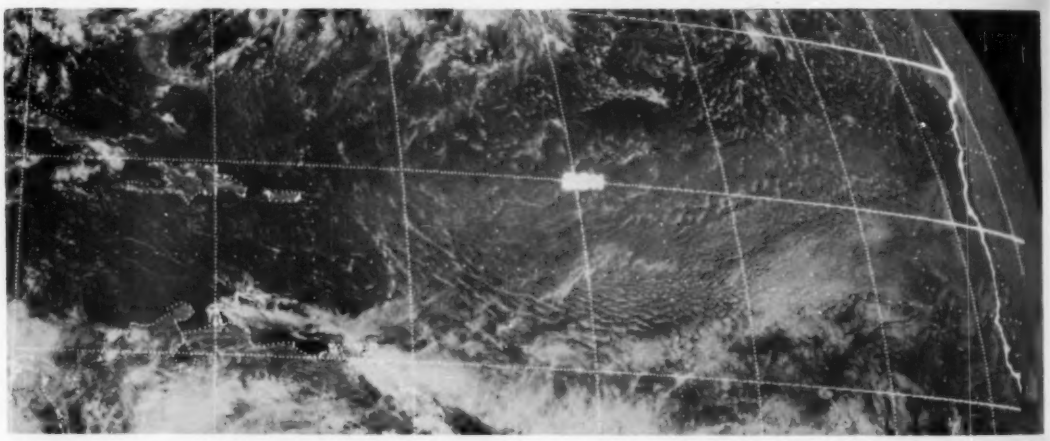


Figure 14.--SMS-1 visible spectrum picture taken at 1700 June 26, 1975, showing Saharan dust near the beginning of its Atlantic transit.

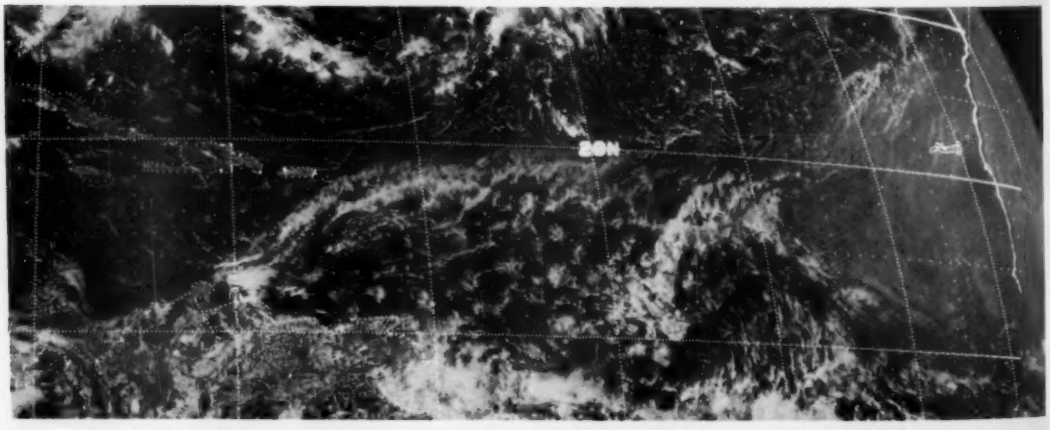


Figure 15.--SMS-1 visible spectrum picture taken at 1800 June 30, 1975, as the dust starts to penetrate the Caribbean.

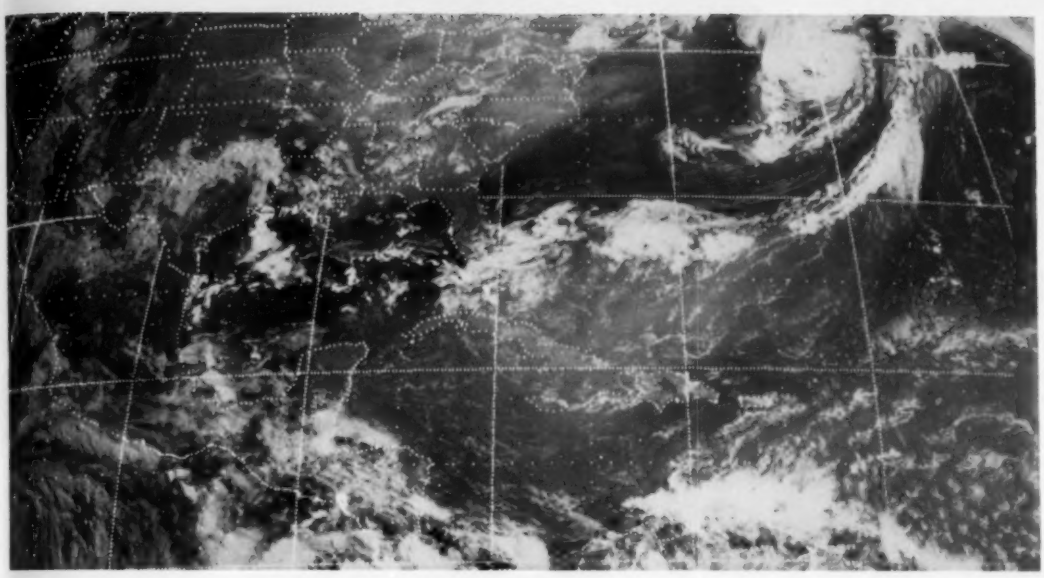


Figure 16.--SMS-1 visible spectrum picture taken at 1330 July 3, 1975, tracks dust to the Yucatan Channel. Tropical storm Amy is clearly pictured at 40°N, 60°W.

ward as far as 37°W. This was actually a concentrated area of dust which had its origin over the Sahara Desert. Carlson and Prospero (1972) have documented the large-scale movement of similar Saharan dust outbreaks over the northern equatorial Atlantic, and Lushine (1975) has discussed a satellite picture of a dust layer in the eastern Caribbean. According to Carlson and Prospero, the dust-laden, heated air emerges from West Africa and moves westward across the Atlantic above the trade-wind moist layer, principally in the layer between 5,000 and 15,000 ft. Although their measurements indicate that the dust concentration is greater at 10,000 ft than at the surface, a sufficient amount of dust can be transferred to the lower levels by fallout of particulate matter and mixing at the base of the dust layer, as the air moves across the Atlantic, to produce a dense haze at the surface.

Figure 15, at 1800 on June 30, indicates the dust had continued its westward movement across the Atlantic at approximately 20 kn, with the leading edge somewhat diffuse over the central Caribbean. By this time, haze had been reported from the Dominican Republic at Puerto Plata, Barahoma, and Santo Domingo, from Puerto Rico at San Juan, and even from Maiquetia, Venezuela. Similar reports came in from the Lesser Antilles at St. Maarten, St. Kitts, Antiqua, Dominica, St. Lucia, and Barbados, and from Trinidad. Surface charts plotted at the National Hurricane Center, on June 30, reveal haze reports from widely scattered ships, confirming the extensiveness of the haze. Among those reporting were the EMERILLON and HOHEME, on the Atlantic between Hispaniola and Bermuda, while the ships HORNSBY WASSON, CLAN MACINNES, and STOLLBERG were off the west coast of Africa. An unidentified ship reported haze in the northeast Caribbean.

Figure 16, taken July 3 at 1300, shows the westernmost edge of the dust entering the extreme southeast Gulf of Mexico. A considerable concentration of this dust was still visible over most of the Caribbean, as well as parts of the southwest North Atlantic. By July 3, haze had been reported from Turks Island and the Isla de Pinos, from Cuba at Rancho-Boyeros, Varadero, Cienfuegos, Cabo Cruz, Camaguey, and Guantanamo, from Grand Cayman Island, from Kingston, Jamaica, and even from Guanaja, Honduras. Guantanamo actually reported a restriction to visibility due to the widespread dust suspended in the air.

In summary, this brief article has demonstrated the ability of satellites to track large-scale areas of dust. Several similar Saharan air outbreaks have been viewed since the launch of SMS-1 in May 1974. With more and more scientists becoming cognizant of these phenomena, the next step will be to determine whether dust has any effect on the development of tropical c[illegible]

REFERENCES

Carlson, T. N., and J. M. Prospero, "The Large-scale Movement of Saharan Air Outbreaks over the Northern Equatorial Atlantic," Journal of Applied Meteorology, 11 (2), 1972, pp. 283-297.

Lushine, J. B., "A Dust Layer in the Eastern Caribbean," Monthly Weather Review 103, 1975, pp. 454-455.

Editor's Note: This article again demonstrates the need for complete and accurate SHIP reports in all areas of the world, particularly data-sparse areas, and almost all areas of the oceans fit this category. These observations are important even though they may contain no severe weather phenomena and aren't often mentioned in the Mariners Weather Log; for example, haze and dust observations were significant in this case.

OCEAN BUOYS SURVIVE EYE OF HURRICANE ELOISE

Roy Clem
National Data Buoy Office, NOAA
Bay St. Louis, Miss.

Hurricane Eloise marked the first time that two of the National Oceanic and Atmospheric Administration's (NOAA) large experimental data buoys were located in the path of the eye of a hurricane. These buoys, EB-04 and EB-10, were developed by the NOAA Data Buoy Office at the National Space Technology Laboratories, Bay St. Louis, Miss., and are anchored in the Gulf of Mexico at latitude 26°N, longitude 90°W, and latitude 27.5°N, longitude 88°W, respectively. The environmental data from these locations, especially EB-10, documented important changes in the direction of the hurricane's track.

The eye of hurricane Eloise passed slightly east of EB-04, the morning of September 22, 1975, and over EB-10 that night (fig. 17). During the passage of Eloise, both buoys continued to operate satisfactorily and furnished valuable surface meteorological data on an hourly basis to the National Hurricane Center in Miami, Fla., and the National Weather Service in Washington, D.C. These automatic data buoys measured windspeeds of over 70 kn, and wave heights of over 40 ft. Other environmental measurements provided by the buoys were sea-level atmospheric pressure, air temperature, and seawater temperature. The lowest pressure was 966 mb, at EB-10.

Except in severe storm conditions when data are required more often, these deep-ocean-moored buoys transmit environmental data automatically every 3 hr to the National Weather Service networks for rapid distribution throughout the nation.

Buoys similar to EB-04 and EB-10 are anchored in the Atlantic and Pacific Oceans, and the Gulf of Alaska. They are designed to withstand 150-kn winds, 60-ft waves, and 10-kn currents. A more detailed article will appear in a future issue.

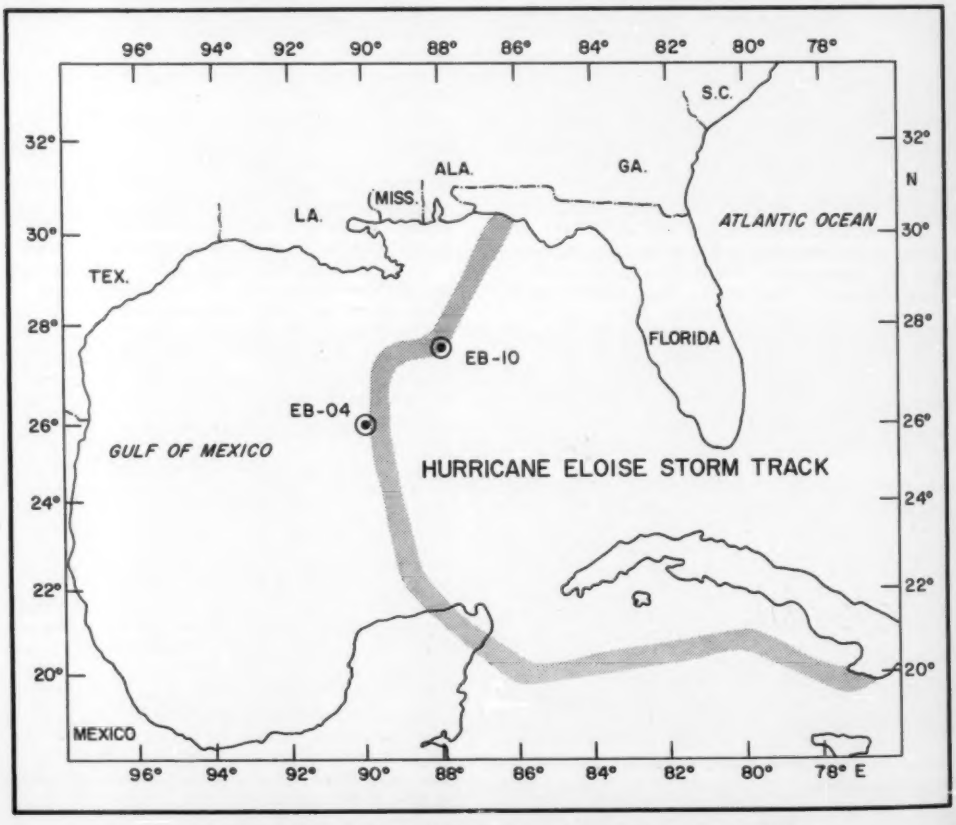


Figure 17.--Hurricane Eloise sideswipes EB-04 and passes over EB-10.

Hints to the Observer

STATIC CHARGE ON MARINE BAROGRAPH

The window of the Model G-222 marine barograph (fig. 18) is made of plastic and develops a static charge when cleaned with a dry cloth. If the air is dry, the static charge does not dissipate and may become strong enough to pull the pen arm off the chart. Damage may result also if the covering case is removed when the pen arm is held against the window by a static charge.

Wiping the barograph case with a damp cloth will provide sufficient conductivity to bleed off the static charge. However, a more lasting effect can be gained by using a few drops of liquid detergent on the damp cloth. A small amount of powdered graphite rubbed on the plastic window will also provide a more permanent "antistatic" coating, although the graphite poses a problem in cleaning. Other substances may be equally as effective, but precautions should be taken to avoid the use of anything that would discolor or damage the plastic window.

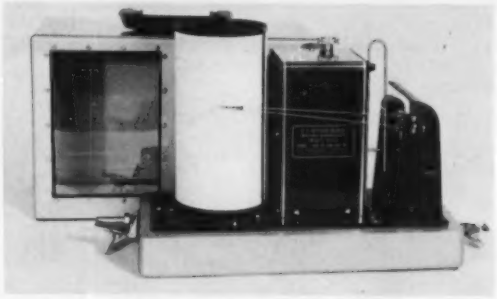


Figure 18.--Model G222 marine barograph. At left, note the plastic window, which may build up a strong enough static charge to pull the pen arm off the chart.

Tips to the Radio Officer

Warren D. Hight
National Weather Service, NOAA
Silver Spring, Md.

CORRECTIONS TO PUBLICATION, WORLDWIDE MARINE WEATHER BROADCASTS

Page 20--Miami, Fla. (NMA): This station has added forecasts to the 0100 and 1600 GMT broadcasts covering Southwest North Atlantic, and also the coastal waters forecast from Jupiter Inlet, Fla., to Key West. The original entry has become cluttered with pen and ink changes. Complete, revised details are as follows:

Station: MIAMI, FLA. (NMA, WDR)
Area Affected:[1]
(a) Offshore waters: Southwest North Atlantic.
(b) Coastal waters: Ponce de Leon Inlet, Fla., to Key West, Fla., including Florida Straits; Cape Sable to Tarpon Springs, Fla., including Florida Bay.
(c) Coastal waters: Jupiter Inlet, Fla., to Key West, including Florida Straits.

Call sign	Time of broadcast	Frequencies (kHz)	Class of emission
NMA	0100, 1600; on receipt	440	A1
WDR	0015[2], 1215[2]; on receipt and even H thereafter	2442[3] 2490 2514[3]	A3 A3 A3

Time of broadcast	Type of message	Contents
0100, 1600	Forecast	Forecast and warnings for areas a and c.
On receipt	Warnings	For areas a and c.
0015, 1215	Forecast	Forecast and warnings for area b.
On receipt and even H thereafter	Warnings	For area b.

[1]See Figure 3, page 11.
[2]Broadcast 1 hour earlier during Daylight Saving Time.
[3]Frequency used during daylight only.

Page 22--New Orleans, La. (NMG, WAK, WNU): Revise the entire listing as follows:

Station: NEW ORLEANS, LA. (NMG, WAK, WNU)
Area affected:[1]
(a) Coastal waters: Apalachicola, Fla. to Port Arthur, Tex.
(b) Gulf of Mexico.
(c) Caribbean Sea.

Call sign	Time of broadcast	Frequencies (kHz)	Class of emission
NMG	0020, 1720; H+18 or H+48[2]	428	A1
NMG	1030, 1230[3], 1630, 2230; on receipt[2]	2670	A3H
WAK	0500, 1400; on receipt and odd H thereafter	2482	A3H
		2598	A3H
		4419	A3H
WNU	0430, 1630; on receipt	478	A1 A2
		2048	A1
		4310[4]	A1
		6495	A1
		8570	A1
		12826.5[5]	A1
		17117.5	A1
		22431[5]	A1

Time of broadcast	Contents of message
0020, 1720	Forecast and warnings for areas b and c.
1030, 1230[3], 1630, 2230	Forecast and warnings for middle Gulf and coastal waters, Biloxi, Miss., to Port Arthur, Tex.
0500, 1400	Forecast and warnings for area affected.
0430, 1630	Forecast and warnings for areas b and c.
On receipt; H+18 or H+48	Warnings

[1]See Figure 3, page 11.
[2]See introduction, page x, for further information relative to transmission of warnings.
[3]Repeat of 1030 broadcast.
[4]Nighttime only.
[5]Daytime only.

Page 23--Galveston, Tex. (NOY): Amend times of the 2670 kHz (A3H) broadcast to read "1050, 1250, 1650, 2250."
Page 24--Port Isabel, Tex. (NCH): Change broadcast times to read "1040, 1240, 1640, 2240.[2]" Note: Footnote 2 should read "Broadcast 1 hr earlier during Daylight Saving Time."

Pages 42-43--Brazil has upgraded marine weather broadcasts by coast stations at Juncao and Olinda, and inaugurated one at Belem. Insert the following information and label it "Page 42a":

Station BELEM, BRAZIL (PPL)
Area affected:
(a) Approaches to Belem Harbor.
(b) Atlantic coast from Uruguay to French Guiana.
(c) South Atlantic; west of 20°W, 07°N-36°S.

Call sign	Time of broadcast	Frequencies (kHz) and mode	Contents
PPL	0100, 0600, 1000, 1200, 1500, 2100	435 (A1)	Synopsis for area affected. In Portuguese and English.
PPL	0400	4265 (A1)	Warnings, analysis, and forecasts for area c. In Portuguese and English.
		8502 (A1)	
		12979.5 (A1)	
		17170 (A1)	
	2020	do.	do. Plus analysis (Code FM 46.D) for area c; reports from Trinidade Is., Fernando de Noronha Is., and Abrolhos Is. (Code FM 11.E); ship reports (Code FM 23.E).

Station: JUNCAO, BRAZIL (PPJ)
Area affected:
(a) Approaches to Juncao Harbor.
(b) Atlantic coast from Uruguay to French Guiana.
(c) South Atlantic; west of 20°W, 07°N-36°S.

Call sign	Time of broadcast	Frequencies (kHz) and mode	Contents
PPJ	0100, 0600, 1000, 1200, 1500, 2100	480 (A1)	Synopsis for area affected. In Portuguese and English.
	0400	4251 (A1)	Warnings, analysis, and forecasts for area c. In Portuguese and English.
		8520 (A1)	
		12840 (A1)	
		17170 (A1)	
	2020	do.	do. Plus analysis (Code FM 46.D) for area c; reports from Trinidade Is., Fernando de Noronha Is., and Abrolhos Is. (Code FM 11.E); ship reports (Code FM 23.E).

Station: OLINDA, BRAZIL (PPO)
Area affected:
(a) Approaches to Recife Harbor.
(b) Atlantic coast from Uruguay to French Guiana.
(c) South Atlantic; west of 20°W, 07°N-36°S.

Call sign	Time of broadcast	Frequencies (kHz) and mode		Contents
PPO	0100, 0600, 1000, 1200, 1500, 2100	480	(A1)	Synopsis for area affected. In Portuguese and English.
	0400	4298	(A1)	Warnings, analysis, forecasts for area c. In Portuguese and English.
		8520	(A1)	
		12840	(A1)	
		17162	(A1)	
	2020	do.		do. Plus analysis (Code FM 46.D) for area c; reports from Trinidade Is., Fernando de Noronha Is., and Abrolhos Is. (Code FM 11.E); ship reports (Code FM 23. E).

Page 55--San Francisco, Calif. (NMC): Effective December 1, 1975, the A3J broadcast frequencies will be changed as follows: 0430, 1030, 1230 broadcasts--4393.4, 8760.8, and 13144 kHz; 1630, 2230 broadcasts--8760.8, 13144, and 17290 kHz.

Page 107-Episcopi, Cyprus (MKS): Delete all broadcast details.

ACKNOWLEDGEMENT OF CORRESPONDENCE

Thanks to Alan L. Van Sickle, REO, AMERICAN ASTRONAUT, a frequent and valuable correspondent, and to Stephen Haust, RO, EXPORT CHALLENGER, for their letters.

Hurricane Alley

Dick DeAngelis
Environmental Data Service, NOAA
Washington, D. C.

There was no tropical cyclone activity over the North Indian Ocean or in the Southern Hemisphere during July and August. We did receive an up-to-date summary of the recent tropical cyclone season in the southwest Indian Ocean. The following report is based on that summary, which was sent to us by the National Meteorological Service of Reunion and translated by Vicki Jones of NOAA.

SOUTHWEST INDIAN OCEAN, 1974-75

Six tropical cyclones were spawned in the seas during the 1974-75 season. While this is well below the 11-storm average, all but 1 reached hurricane intensity. Three formed in January, two in February, and one in March. Gervaise was the superstorm, as winds near her center were estimated at 150 kn. Table 3 is a summary of this recent season, and figure 19 shows the tracks.

Table 3.--Summary of southwest Indian Ocean tropical cyclone season, 1974-75

Number	Name	Intensity*	Dates	Maximum wind (kn)	Lowest pressure (mb)
1	Blandine	H	January 6-12	100	960
2	Camille	H	January 12-21	80	995
3	Deborah	H	January 18-29	100 to 110	960
4	Gervaise	H	February 2-10	150	951
5	Heloise	H	February 19-26	80	985
6	Ines	T	March 8-19	50 to 60	985

*H - hurricane; T - tropical storm.

Blandine was the first of three hurricanes to move through the Mozambique Channel. She brought strong winds to the Madagascar coast in early January. Gusts reached 60 kn at Majunga, and 78 kn at Morombe. Less than a week later, Camille barreled through the Chan-

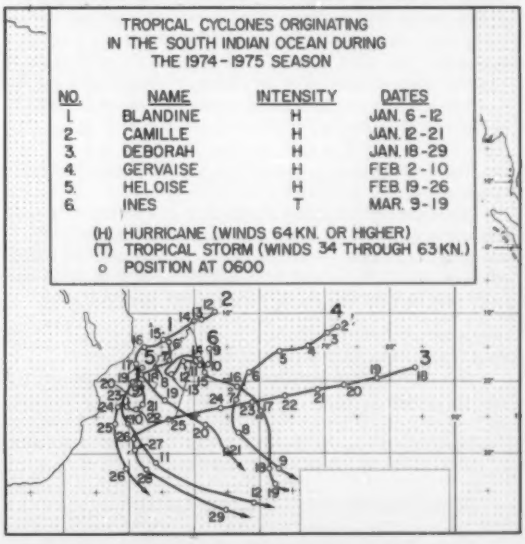

TROPICAL CYCLONES ORIGINATING
IN THE SOUTH INDIAN OCEAN DURING
THE 1974 - 1975 SEASON
NO. NAME INTENSITY DATES
1. BLANDINE H JAN. 6 - 12
2. CAMILLE H JAN. 12 - 21
3. DEBORAH H JAN. 18 - 29
4. GERVAISE H FEB. 2 - 10
5. HELOISE H FEB. 19 - 26
6. INES T MAR. 9 - 19
(H) HURRICANE (WINDS 64 KN. OR HIGHER)
(T) TROPICAL STORM (WINDS 34 THROUGH 63 KN.)
o POSITION AT 0600

Figure 19.--Tracks of 1974-75 tropical cyclones in the southwest Indian Ocean.

nel. She was accompanied by 24-hr 4-in rains, with winds gusting up to 100 kn along the Madagascar coast. Strongest winds were recorded at Morondava. Before January was finished, hurricane Deborah moved on a parabolic arc that took her across the southern tip of Madagascar. At Fort Dauphin, winds gusted to 84 kn before the anemometer tower blew down.

In early February, Gervaise, the superstorm, clobbered St. Brandon, Mauritius, and Reunion. She was most potent near Mauritius, where winds blew at 85 to 105 kn, with gusts to 150 kn. Torrential rains totaled 18 to 27 in over a 2-day period. The storm's lowest pressure was measured on the island--951 mb. Many houses, power and communication lines, and roads were damaged or destroyed. Six people were killed, and thousands left homeless. The sugar cane crop loss was estimated at 25 to 40 percent. Reunion and St. Brandon suffered also. Winds on these islands reached 55 to 65 kn in gusts, while rains totaled 10 to 22 in.

Heloise formed, on February 19, in the middle of the Mozambique Channel. However, before reaching hurricane strength, she had moved to the south. Madagascar and the island of Europa suffered gale-force winds.

March brought the last storm of the season to the other side of Madagascar. Ines was responsible for 50-kn gusts and 10 to 14 in of rain along the northwest coast.

TROPICAL CYCLONE NAMES

This list for the 1975-76 tropical cyclone season in the southwest Indian Ocean was furnished by the National Meteorological Service of Reunion.

Audrey	Io	Rita
Barbara	Jacqueline	Sonia
Clotilde	Kiki	Therese
Danae	Luce	Ursule
Ella	Marylou	Valerie
Frederique	Nadine	Yvonne
Gladys	Odile	Zoe
Heliotrope	Patsy	

On the Editor's Desk

SAN FRANCISCO VOICE WEATHER BROADCASTS

The Coast Guard has announced that, on December 1, their San Francisco Communications Station (NMC) will combine its High Seas Voice Weather broadcasts on the same frequencies that it uses for the Automated Mutual Assistance Vessel Rescue System (AMVER) and weather data collection. Mariners will now be able to crystalize their communications equipment on one family of frequencies for both receiving and reporting weather information.

On the 4-MHz band, ships will transmit at 4094.8 kHz and receive at 4393.4 kHz. On the 6-MHz band, ships will transmit at 6207.2 and receive at 6521.8 kHz. On the 8-MHz band, vessels will transmit at 8226.8 and receive at 8760.8 kHz. Ships wishing to use the 12-MHz band will transmit at 12365.0 and receive at 13144.0 kHz. On the 16-MHz band, ships will transmit at 16495.0 and receive at 17290.0 kHz. All the above frequencies are suppressed carrier frequencies.

The Communications Station will use its transmit frequencies for broadcasts on the following schedule, starting on December 1: at 0430, 1030, and 1230 GMT, on 4393.4, 8760.8, and 13144.0 kHz; and at 1630 and 2230 GMT, on 8760.8, 13144.0, and 17290.0 kHz.

SEAWAY - CANAL WINTER CLOSINGS

The St. Lawrence Seaway Authority has announced the following closing dates for the winter ice season:

December 18, 1975--Montreal-Lake Ontario section of the St. Lawrence Seaway.

December 30, 1975--Welland Canal.

December 12, 1975--Canadian Sault Ste. Marie Canal.

POLLUTION SURVEILLANCE SYSTEM TESTED

The U. S. Coast Guard has completed successful testing of an aerial pollution-surveillance system capable of detecting oil spills in all types of weather, day or night. The prototype Airborne Oil Surveillance System (AOSS) is able to detect, map, and document oil spills on the high seas despite darkness or cloud cover.

During a routine test flight aboard a Coast Guard HU-16 aircraft (fig. 20), the AOSS detected a suspected pollution violator through 2,000 ft of cloud cover off the coast of California. Findings of a resulting civil proceeding may set important precedents for the use of supporting sensor evidence in future pollution cases.

The prototype AOSS includes a side-looking radar,

Figure 20.--A prototype airborne oil surveillance system, installed on this HU-16 Coast Guard Amphibious Aircraft, maps and documents oil spills at sea. U.S. Coast Guard Photo.

a passive microwave imager, a multichannel line scanner, a multispectral low-light-level television, and a position reference system. Data from all sensors are processed and displayed on a central display console.

Aircraft with the sensor system on board would typically begin a long-range surveillance mission at 5,000 ft, using the side-looking radar to scan, map, and locate vessels within an area 25 mi on either side of the aircraft (the prototype installation was limited to the right side of the aircraft). The radar also detects and records oil slicks as a result of the oil's damping effect on the water's wave action. The system's passive microwave imager penetrates weather conditions and maps vessels and oil slicks directly beneath the searching aircraft which might otherwise go undetected.

A close-range inspection follows, using the infrared channels of the line scanner to detect temperature differences between the surrounding water and the oil slick. The ultraviolet channel responds to the reflectance differences of oil and water for additional evidence of a spill.

All of these sensors provide input into a computer-controlled system that processes the information and displays the type of imagery desired by the sensor operator. The combined data of the multisensor system prevents error from "blind spots" that may occur due to the inability of any one of the individual sensors to operate in a particular set of weather or lighting conditions.

Plans are presently underway to make necessary design improvements in the sensor "package" and to install the system in a larger C-130 aircraft. The increased weight capacity of this aircraft will allow significant improvements in the detection system. The Coast Guard also plans to install operational versions of the AOSS in a number of new jet aircraft, when the outdated HU-16's are replaced.

FLEET OF 25 SHIPS TO MONITOR OIL SLICKS

NOAA's 25-ship fleet has been directed to monitor slicks and other oil pollutants as part of a United Nations program called Integrated Global Ocean Station System (IGOSS). NOAA's participation in IGOSS is part of a worldwide pilot program designed to pave the way for the monitoring of marine pollutants on a global scale. The 2-yr program is organized by the U.N.'s Intergovernmental Oceanographic Commission and the World Meteorological Organization.

The Office of Technology of the U.S. Senate Commerce Committee will soon publish an analysis of marine pollution and safety measures in a report entitled "Oil Transportation by Tankers." This report shows that about 1 million tons of oil a year are dumped into the ocean in standard tanker operations such as tank cleaning and deballasting. Additionally, about 200,000 tons of oil are spilled yearly as a result of tanker casualties, and an added 250,000 tons of oil pollution annually is associated with tanker dry-docking activities.

The U.N. program recognizes that marine pollution must be dealt with on a global scale as a threat to fisheries, recreation sites, environmental values, and human health. Little is known about these myriad effects. Meanwhile, the problems are intensifying because populations are expanding, the oceans are being increasingly used for transporting fuel and minerals, seabed oil and gas drilling are growing, and seabed mining is just over the horizon.

The monitoring activities of the NOAA ships will cover areas in the Atlantic Ocean, Gulf of Mexico, Pacific Ocean, and Bering Sea, and will include both inshore and offshore water. In addition to monitoring oil slicks, vessels with appropriate equipment will collect samples of oil tar balls. Other ships will gather, for laboratory analysis, samples of dissolved petroleum hydrocarbons from the upper 3 ft of the ocean.

The information gathered by U. S. participants is being forwarded to NOAA's National Oceanographic Data Center. The data will be archived and exchanged among nations so periodic assessments can be made of the state and degree of ocean contamination.

U.S. participants in the IGOSS program, in addition to the NOAA fleet, include the Coast Guard, Defense Department, academic institutions, and cooperating ships of the commercial fleet, which are recruited through the Port Meteorological Officer element of NOAA's National Weather Service. A sample form to be used in pollution reporting is shown in figure 21.

IOC/WMO IGOSS MARINE POLLUTION MONITORING PILOT PROJECT

OBSERVATION/PLATFORM HEIGHT ABOVE SEA LEVEL _____ Meters

NOAA FORM 72-8 (1-78)

U. S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Form Approved O.M.B. No. 41R2835 Expires December, 1979

LOG FOR OBSERVATION AND REPORTING OF OIL SLICKS AND OTHER FLOATING POLLUTANTS

PLATFORM/SHIP				INSTITUTE/ORGANIZATION
TYPE	NAME	FLAG	RADIO CALL	

DATE/TIME G.M.T.					LOCATION					POLLUTION DATA				COVERAGE (1/10 N. Miles)		ENVIRONMENTAL DATA								REMARKS
					QUAD	LAT.		LONG.						ALONG	ACROSS	WIND			WAVE					
DAY	MO.	YEAR	HR.	MIN.		DEG.	MIN.	DEG.	MIN.					TRACK	TRACK	UNIT	DIR.	SPEED	PER.	HT.				
Y Y	M M	J J	G G	g g	Q_c	L_a L_a	L_a L_a	L_o L_o L_o	L_o L_o	A	B	C	D				d d	f f	P_w P_w	H_w H_w				

Figure 21.--NOAA Form 72-8 for reporting observations of oil slicks and other pollutants.

FOUR HELICOPTERS RESCUE 36 CREWMEN FROM SHIP BROKEN BY WEATHER

Battling snow, sleet, and high winds, four U. S. Coast Guard helicopters plucked 36 crewmen from the decks of the ill-fated SPARTAN LADY. The 557-ft, oil-laden tanker broke up in 20-ft seas, on April 4, 165 mi southeast of New York (fig. 22).

Advised at 1220 that an S O S had been picked up from the SPARTAN LADY, the Coast Guard's New York Rescue Coordination Center (RCC) immediately dispatched two HH-3F amphibious helicopters from Brooklyn Air Station to the scene. Two other HH-3F helicopters from Cape Cod Air Station were also directed to the scene by RCC Boston, and the Coast Guard Cutter HORNBEAM was diverted to the scene. The USCGC ALERT notified RCC New York that she was proceeding to the scene, but that she was being hampered by heavy weather.

Moments later, RCC New York, the Search and Rescue (SAR) Marine Coordinator, issued a distress broadcast and dispatched a C-130, equipped with five pumps and four 20-man rafts, from Elizabeth City, N.C.

Nearly 1-1/2 hr later, SPARTAN LADY was located at 39°02'N, 71°W. She was broken in half, and her bow section was 2 mi northeast of her stern section. The helicopters began hoisting the crewmen aboard, three of them removing 28 people from the stern section (fig. 23), while the other one hoisted the remaining 8 crewmen from the bow section. The helicopters then returned to their respective air stations, where the crewmen were disembarked and taken to local hospitals. Of the 36 crewmen, all were in fair condition except 1 , who was unconscious. He died, apparently of a heart attack.

At 1630, ERICH WEINERT, one of the ships that had responded to the distress broadcast, arrived in the area, and two other vessels diverted to the scene were released from the case. The C-130 also departed and returned to Elizabeth City.

Shortly after ERICH WEINERT arrived, the Coast Guard Cutters TAMAROA and FIREBUSH got underway and headed for the scene. ERICH WEINERT, assessing the situation, radioed that both sections were afloat and appeared stable, although the screw was still turning, and the two sections were 5 mi apart.

With relief approaching, all vessels were released from the case except the ALERT, which was to remain until the other two vessels arrived. When TAMAROA and FIREBUSH arrived, in the late morning of April 5, the ALERT departed the scene. The two vessels were to stand by until a tug dispatched by the owners of SPARTAN LADY arrived to evaluate the possibilities of salvaging her and towing her to port.

While waiting for the tug, the SPARTAN LADY began drifting toward the Gulf Stream and picking up speed. By 1600, the TAMAROA, watching the stern section, was in position 37°27'N, 68°22'W, 10 mi from the FIREBUSH and the bow section.

Throughout their vigil, the storm raged on. When the tug arrived, on the evening of April 6, it was unable to place a man aboard the SPARTAN LADY to assess the situation. The main deck and port forward of the poop deck were submerged or awash. The FIREBUSH was released from the case, while the TAMAROA and the tug stood by as the stern section sank, early on the morning of April 7. The Coast Guard Cutter SHERMAN, underway to replace the FIREBUSH, was released, and the tug departed for port. The TAMAROA remained in the area to sink the bow section with gunfire, at 37°02'N, 67°49'W, and then returned to her home port at Governors Island, N.Y.

Figure 22.--The bow of the SPARTAN LADY drifts helplessly in high seas. U.S. Coast Guard Photo.

Figure 23.--Crewmen aboard the sinking stern section of the SPARTAN LADY anxiously prepare to board basket from a rescue helicopter. U.S. Coast Guard Photo.

SOLAR FLARES HERALD NEW 11-YR CYCLE OF ACTIVITY; MAGNETIC MYSTERY AT SOLAR MINIMUM

Late last August, an active area on the Sun produced a series of moderate to major flares that reverberated in the Earth's magnetic field, disturbed the ionosphere (the electrically charged layer of the upper atmosphere), and dusted our corner of space very lightly with energetic solar protons (fig. 24). For NOAA scientists, the active region and its flares meant more than a temporary increase in solar activity--they also marked the coming of a kind of springtime on the Sun, when one 11-yr cycle nears its end, and another one begins. The August flares were the first significant activity of the new cycle, number 21. Now, solar activity will gradually increase to a maximum in 1979 or 1980, then diminish toward the next solar minimum about 1986.

The recent activity occurred in conjunction with a sunspot group at about solar latitude 28°N. This sunspot group also had the magnetic configuration of a new cycle. In the solar cycle, sunspots first tend to form at solar latitudes between about 20° and 30°; then, as the cycle continues, they occur closer and closer to the solar equator, coming within about 5° of the equator by the solar minimum. Most sunspot groups consist of pairs of magnetic fields, oriented east-west. In each 11-yr cycle, these sunspot fields in the Sun's northern and southern hemispheres--always magnetic mirror images of one another--are the opposite of similar fields in the preceding solar cycle.

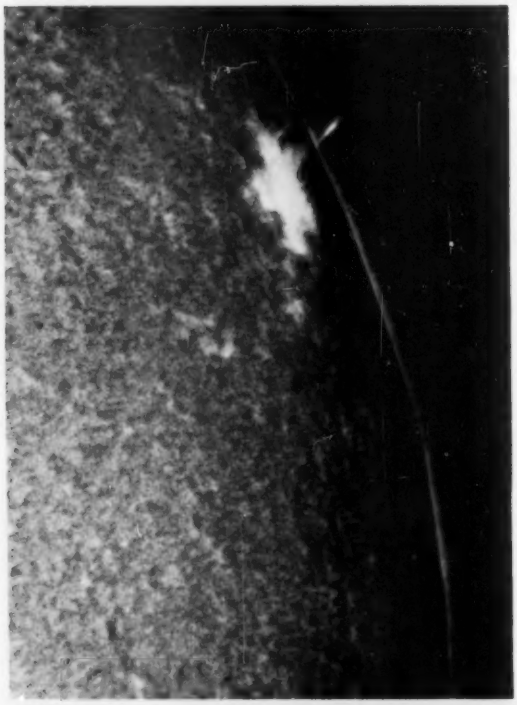


Figure 24.--This photo of the Sun shows the region which produced a series of moderate to major solar flares, the first significant activity of a new 11-yr cycle of solar activity.

It is generally held that, as each sunspot group in a developing cycle fades away, its eastern half remains as a faint but detectable magnetic residue which drifts slowly toward the nearest solar pole. Three or four years after the new cycle has begun, enough of these magnetic remnants have accumulated over the north and south poles to form a weak but uniform magnetic field there. This field remains until residual magnetism of sunspot groups in the next solar cycle drifts in to create a magnetic field of opposite polarity.

The advent of a new cycle cued scientists to begin looking for the end of the old cycle, and for the "impossible" solar magnetic field which researchers think--but can scarcely believe--comes at the solar minimum. Past data suggest that then the Sun's normal two-pole magnetic field takes on a single polarity for three solar rotations (about 3 mo), a performance that is not supposed to be possible in the physical world.

The Sun's magnetic field has a large-scale pattern that appears to divide the 360° of solar longitude into four magnetic sectors, alternately pointing out from the Sun's surface and in toward the core (fig. 25). These magnetic field sectors are carried into interplanetary space by the solar wind, a thin flow of energy that "blows" from the Sun, so that measurements of the interplanetary magnetic field can be read as a measure of the Sun's magnetic field.

During the last solar minimum, in 1965, this sector pattern disappeared for about 3 mo, and the magnetic field became almost totally directed away from the Sun, suggesting a magnetic field with only one pole. There is no known explanation. The phenomenon is so strange that there is a temptation to say the observing equipment was malfunctioning, but there were several independent kinds of observations that pointed toward the validity of this phenomenon of single polarity. Among these were observations at Mt. Wilson Observatory in California, which indicated the magnetic field in almost every part of the Sun had become outwardly directed. Cosmic ray physicists, who measure the interplanetary magnetic field by the way it bends the trajectories of cosmic rays, also detected a one-directional field during the 1965 solar minimum.

Scientific examination of data for the past five solar minima, going back into the 1920's, seems to corroborate this effect. These retrospective measurements are made by analyzing past records of the Earth's magnetic field made near the northern magnetic pole--for example, at Thule, Greenland--where the interplanetary field can be inferred.

With the end of old cycle number 20 now just a few months away, scientists will have their first opportunity to see whether this strange magnetic event happens again, or whether it happens at all. Scientists at NOAA observatories, and their colleagues in other Sun-watching installations around the world, will be observing a variety of phenomena with ground-based and satellite instruments, in the hope of confirming the magnetic monopolarity at the solar minimum, and discovering its causes. Intensive observations will also be made by scientists at Stanford's observatory and at a Soviet facility in the Crimea, both equipped to observe the Sun as a star.

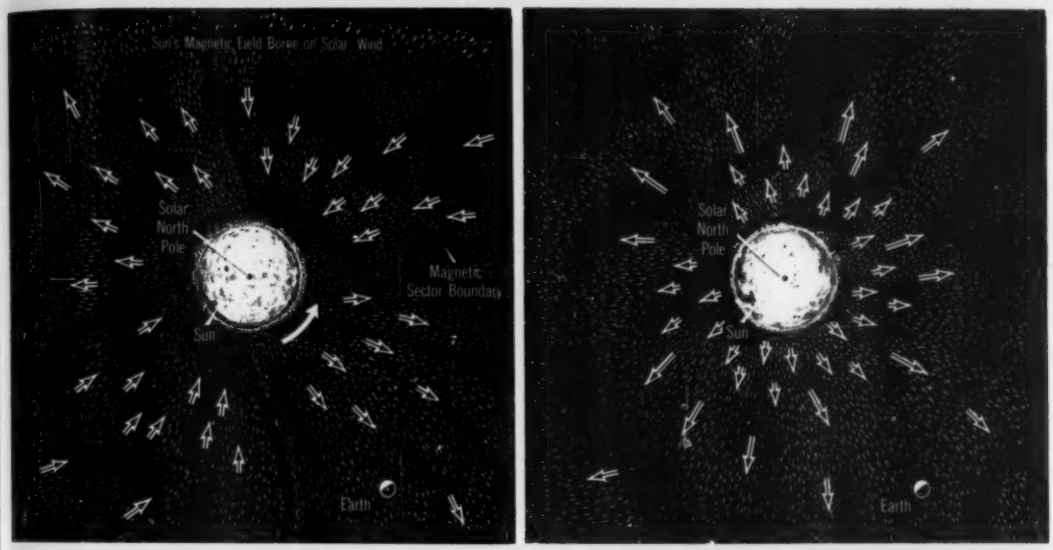


Figure 25.--Normally (above, left), the Sun's magnetic field has a large-scale pattern divided into four magnetic sectors which rotate with the Sun, and whose magnetic fields alternately point out from the Sun's surface and in toward the core. During the solar minimum (above, right), scientists have observed an "impossible" change in the Sun's magnetic field. Then, for about 3 mo, the normal sector boundaries disappear, and the solar magnetic field becomes unipolar, all pointing outward from the Sun.

EPIRB LEADS RESCUERS TO SINKING YACHT

An EPIRB probably can be credited with saving the lives of the three men aboard the 31-ft sloop BANJO. The EPIRB (Emergency Position Indicator Radiobeacon) is a small transmitter that broadcasts a distress signal over two frequencies.

The BANJO was about 330 mi north of Bermuda and heading toward Long Island, when caught by hurricane Blanche. Within a few hours, the yacht was running under bare poles and trailing warps in the heavy seas due to 50-kn easterly winds. Winds in the storm were over 80 kn.

An exceptionally large wave caused extensive damage, with water coming in around the rudder post. The electric bilge pump went out, and the manual pump could not handle the water.

A Coast Guard Search and Rescue plane found the BANJO within 4 hr after the EPIRB was activated. A pump was dropped by the aircraft, but the damaged yacht was unable to maneuver enough to pick it up. A second rescue plane arrived and dropped another pump, which was retrieved.

The Coast Guard Cutter CHILULA was enroute from Norfolk, but still a day away. By this time, the BANJO was so badly damaged, and leaking at such a rate, that the skipper decided to abandon her. The Dutch passenger liner VEENDAM, bound for New York, had diverted toward the sloop, and the three men boarded their liferaft and rowed to the waiting ship.

NOAA ESTABLISHES OFFICE OF MARINE MINERALS

An Office of Marine Minerals has been established in the National Oceanic and Atmospheric Administration. NOAA was first assigned marine mining responsibilities when it was formed in 1970. The new office will report to the Associate Administrator for Marine Resources and will serve as a focal point for NOAA's new and expanding programs in marine minerals. It will have planning, coordinating, and certain operational responsibilities. It will also facilitate liaison with other Federal agencies.

The development of marine mineral resources of the deep ocean and of the continental shelf will become increasingly important to the economic well-being of the United States. This must be done in an environmentally sound, yet efficient, manner. To do this, NOAA is embarking on the expanded program, which will bring together its broad capabilities.

The major new effort to be launched is the Deep Ocean Mining Environmental Study (DOMES), to be conducted in FY 1976, for which $3 million was included in the NOAA budget now before the Congress. This study will assess the premining environment of selected manganese-nodule mining areas in order to be able to predict the potential environmental consequences of deep-ocean mining. In addition, in FY 1976, mineral resource-related programs will be sponsored by NOAA's Office of Sea Grant at a level of approximately $750,000, including matching funds.

INTERNATIONAL NAUTICAL CHART ISSUED FOR NORTHEAST PACIFIC

NOAA has announced the publication of the first of five international charts to be produced as part of a multination program sponsored by the Monaco-based International Hydrographic Organization (IHO). The chart, prepared by the National Ocean Survey, covers a vast area of the Pacific Ocean off the west coast of the United States and Canada (fig. 26).

The IHO program is designed to provide a standard series of charts for the entire world, which can be used by all nations. Each member nation is authorized to reprint charts in its own language, but employing the same form of navigational information, such as depth curves, sounding spacing, aids to navigation, and nautical symbols. Nations which have agreed to produce and issue international charts are Canada, West Germany, the United Kingdom, France, Brazil, Argentina, Chile, Italy, the Netherlands, Japan, India, New Zealand, Australia, and possibly South Africa.

The chart was compiled in accordance with IHO specifications, and is the Survey's first metric nautical chart. (The U.S. Defense Mapping Agency's Hydrographic Center and foreign nations have previously issued metric international nautical charts.) The new chart has a 1:3,500,000 scale. Loran-A lines of position for electronic navigation are shown in addition to the usual nautical chart information.

The chart, International Chart INT. 501 (National Ocean Survey Chart 501) is priced at $3.25, and may be obtained from the NOS Distribution Division (C44), Riverdale, Md. 20840.

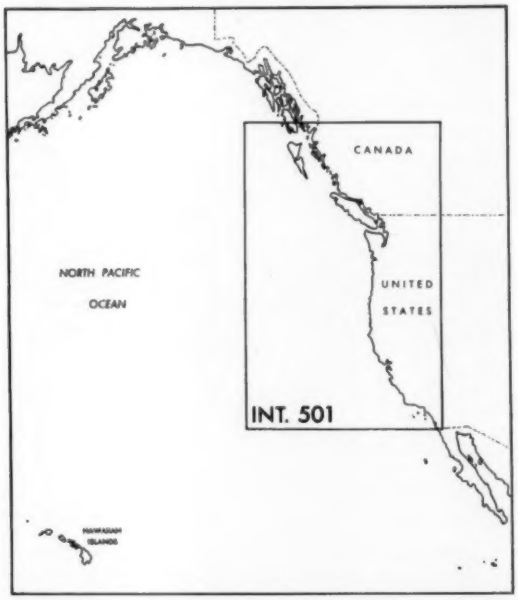


Figure 26.--First international standardized chart produced by the National Ocean Survey.

SCIENTISTS CONDUCT DEEP-SEA-MINING STUDY

Government and university scientists aboard the NOAA research ship OCEANOGRAPHER are conducting a 3-mo environmental study of the tropical Pacific, as part of a major NOAA effort to define the potential effects upon the environment of deep-sea mining. The investigation focuses on three research sites southeast of Hawaii, in an area where high concentrations of metallic nodules, rich in manganese, copper, cobalt, and nickel, have been found on the ocean floor. Commercial mining of such nodule beds is expected to begin within a few years.

More than 30 scientists are participating in the voyage, which ends November 20. The team is studying all aspects of the marine environment--physical oceanography, chemistry, meteorology, geology of the ocean floor, and marine life. Projects include estimating population and distribution of zooplankton; analyzing water salinity, temperature, and content; determining solar radiation both above and below the water surface; and gathering data concerning the ocean bottom.

The effort is part of the Deep Ocean Mining Environmental Study (DOMES) managed by the Marine Ecosystems Analysis Program Office of NOAA's Environmental Research Laboratories. The project's first phase is a series of baseline studies of the premining conditions of possible mining sites. The current research endeavor is the third to be conducted under the ocean-mining study, and the most ambitious.

The emphasis in the early part of the voyage is on the upper water column. An acoustic echo sounder is used to estimate zooplankton population and distribution by observing signals reflected from these tiny sea creatures. Nets are lowered to depths of up to 750 m, or towed from a 7.5-m boom on the ship, to collect zooplankton samples for more detailed analysis. With an instrument that measures amounts of light transmitted or reflected--and therefore the cloudiness of the water--the team makes profiles of suspended material. Other instruments measure salinity and temperature of the water at different depths down to 1,000 m.

Researchers additionally are collecting water samples to be analyzed for dissolved oxygen, nutrients, phytoplankton, suspended particulates, microzooplankton, and other properties, and measuring solar radiation both above and below the water surface. Meteorological variables that affect the upper ocean are also being observed and measured--windspeed, sea-surface temperature, air temperature, rainfall, insolation (solar radiation), and type and amount of clouds.

Other investigations focus on the ocean bottom. Soundings are being made to map the contours of the ocean floor in the project area, and, in a cooperative program with the U.S. Geological Survey, bottom samples are being collected to determine sediment characteristics and study the living inhabitants of the sea floor. Underwater cameras will add visual images.

Many of the samples collected during the voyage will be analyzed aboard the OCEANOGRAPHER, a floating laboratory built especially for deep-ocean surveys and research. The 300-ft, 3,800-ton ship is operated by NOAA's National Ocean Survey from the Pacific Marine Center in Seattle.

LETTERS TO THE EDITOR

LIGHTNING DISPLAY FOR THE TANKER PASADENA

This account of an electrical storm at sea, on July 7, 1975, was sent to Julius Soileau, the Port Meteorological Officer at Houston, Tex., by 2d Mate Michael Hopkins of the PASADENA. The photographs were taken by Able Seaman Pepe Fereinando. They are not nearly as dramatic when reproduced in black and white as they were in color, but the intensity of the lightning can be visualized by noting how clearly the details of the ship and the sea can be seen.

"Electrical storms at sea generally don't cause as much stir as they do on land, but a storm of about 5 hr duration off the east coast of Florida, on July 7, 1975, got everyone up for a look on the Trinidad tanker PASADENA. A 40-yr seagoing veteran, Morris Czerniak, who was on watch while the storm passed over the ship, admitted that even he was surprised at the almost continuous series of lightning bolts.

"The ship was northbound in the Gulf Stream, passing Jupiter Inlet Light about 1840 (local time). The storm seemed to build slowly over mainland Florida, where the high cloud bank and lightning could be seen against the nearly clear sky at twilight. When the electrical storm crossed the ship's track, about 2300, in position 28.1°N, 79.7°W, lightning was so nearly continuous that it appeared as if the sun had risen in the middle of the night.

"Able Seaman Pepe Fereinando, also on watch at the time, took 20 color exposures with a 35-mm camera. In order to get the photographs, he used a 5-s exposure at the lowest available F-stop, with 80 ASA color film.

"As the photograph vividly indicates (fig. 27), it was almost continuously light, especially at the time the storm was in the vicinity of the ship. The storm contained very little wind or rain, and from 2000 to 2400, there was only a 0.02-in increase in the barometer, from 30.00 to 30.02 in. Air temperature dropped from 84° to 78°F, and water temperature remained the same, at 84°F."

Figure 27.--Off the bow of the PASADENA, a lightning strike is plainly visible, and the night sky is brilliantly lit.

MARINE WEATHER REVIEW

The SMOOTH LOG (complete with cyclone tracks [figs. 29-32], climatological data from U.S. Ocean Buoys [table 4], and gale and wave tables 5 and 6), is a definitive report on average monthly weather systems, the primary storms which affected marine areas, and late-reported ship casualties for 2 mo. The ROUGH LOG is a preliminary account of the weather for 2 more recent months, prepared as soon as the necessary meteorological analyses and other data become available. For both the SMOOTH and ROUGH LOGS, storms are discussed during the month in which they first developed. Unless stated otherwise, all winds are sustained winds and not wind gusts.

Smooth Log, North Atlantic Weather

May and June 1975

SMOOTH LOG, MAY 1975--May is generally a confused month for storm tracks, and this one was no exception. Climatically, the storm tracks from the west, the southwest, and off the U.S. east coast converge over the Gulf of St. Lawrence and then diverge into the Labrador Sea and toward the Faeroe Islands. This month, they converged south of Nova Scotia--the gross coordinates were 39°N, 63°W. From that point, the track was eastward, and then northward along 40°W, to the west coast of Greenland. Two storms made the grand tour to the continent--one to France and the other to England. There was a minor track across Spain and the northern Mediterranean.

According to the climatological mean sea-level pressure charts, the Icelandic or North Atlantic Low is a weak area between the Bermuda-Azores High and a polar High. The point of lowest mean pressure is near 57°N, 37°W, at 1012.3 mb. This month, the closed 1007-mb center was near 51°N, 44°W. The two Highs were present and nearly encircled the Low. A ridge of the Bermuda-Azores High extended northward west of the continent, with a 1020 isobar joining the polar High. There were two 1024-mb centers, one at 33°N, 28°W (versus 1022 mb at 30°N, 40°W, the climatological center) and the other at 59°N, 10°W, with no climatological counterpart. A ridge from the polar High extended southward across northeastern Canada as far south as the north shore of the Gulf of St. Lawrence. This left the only entrance to the Icelandic Low along and off the East Coast, and this was the path the storms took.

The anomaly pattern had several major centers, only one of which was negative. That center was minus 6 mb, centered near 49°N, 43°W. The major positive centers were a 5-mb near the Canary Islands, a 10-mb near 59°N, 12°W, an 8-mb over central Greenland, and a 5-mb over northern Labrador.

In the upper air (700 mb), the long-wave pattern was nearly normally placed, but the troughs and ridges were much sharper than the climatological pattern indicates. This produced positive anomalies over the North American east coast, negative over the western ocean, and positive over the northeastern ocean.

There were no tropical cyclones this month. On an average, only one occurs each 5 yr.

Extratropical Cyclones--A small LOW formed near Savannah, Ga., on the 4th, as a HIGH moved off the central East Coast. At 1200, it had moved over Cape Hatteras at 1004 mb. At about the same time, another LOW formed just north of Bermuda. The CHEVRON BURNABY was at 40.2°N, 61.9°W, north of the second center, and measured 45-kn easterly winds. By 1200 on the 5th, the two LOWs had combined into a single center of 996 mb, near 37°N, 67°W. At 0000 on the 6th, three ships reported gale-force winds north and east of the center. By 1200, gales were blowing all around the storm. The CAVALA reported 40-kn winds and 20-ft swells at 38.8°N, 68.9°W, and the AMERICAN LEADER had 38-kn winds and 20-ft swells near 40.2°N, 55.7°W. The winds decreased to 35 kn for the AMERICAN LEADER, 12 hr later, but the swells built to 25 ft. At 1200 on the 7th, the MANCHESTER VIGOUR (40°N, 64°W) had 35-kn gales and 20-ft waves.

The LOW was headed toward Cape Breton Island and, on the 8th, disappeared over the Gulf of St. Lawrence.

A front stretched east-west along the coast of the Gulf of Mexico on the 8th. At 1200, a wave was analyzed, again off Savannah, Ga. For approximately the first 30 hr, it was stable and slowly moved eastward. By the 0000 chart of the 10th, it had become unstable and was deepening and developing a compact circulation. At 1200, the EXXON HUNTINGTON, off Wilmington, N.C., had 35-kn winds and squalls in sight. At 1200 on the 11th, the 1004-mb LOW was near 39°N, 63°W. The AMERICAN ALLIANCE (37°N, 59°W) was east of the cold front in the warm sector, and reported only 15-kn winds with 10-ft seas from 230°, but 46-ft swells from 200°.

The center of the LOW moved over Cape Race, about 1400 on the 12th. Twelve hours later, the HUDSON was 300 mi south of the center with 35-kn gales. On the 14th, the LOW passed between OWS JULIETT and OWS KILO with only breezes. Late on the 16th, it moved inland over the west coast of France.

This storm originated over Louisiana on the 14th. It crossed the New Jersey coast, about 1000 on the 16th,

still a 1010-mb wave. Rapid changes in the upper air were taking place on the 17th and 18th, as the surface storm raced eastward. There was no one main center during this time, but several centers of the same pressure. On the 18th at 1200, there was a 976-mb center near 48°N, 45°W. The circulation had expanded and deepened greatly as the storm came under the main upper-air LOW. The EWAE was at 45.7°N, 51.9°W, with 55-kn northwesterly winds and 12-ft seas. The AGAMEMNON and CETRA COLUMBA, in the southwest quadrant, had 40-kn gales. Many miles to the east, ahead of the occlusion, two ships reported 35-kn southerlies. At 1800, the CARBO SIERRA was hammered by 60-kn winds and 20-ft waves, at 43.5°N, 44.4°W. At 0600 on the 19th, she still was fighting 55-kn winds and 20-ft waves.

At 0000 on the 19th, the BORKUM was about 250 mi south of the center, with 50-kn westerlies and 39-ft seas on her starboard side. The KOHNAN MARU (41.5°N, 49°W) had 40-kn gales, while the SHURA KOBER (42.5°N, 46°W) had 30-kn gales with 26-ft seas.

Gale-force winds continued to blow as the surface center meandered under the upper-air LOW. At 0000 on the 20th, the LEVERKUSEN had 45-kn winds, and the ATLANTIC CHAMPAGNE had 40-kn winds and 23-ft swells, near 43.5°N, 41.5°W.

At 1200 on the 22d, the low-pressure area resembled a four-lobe cam, with four separate centers. Twenty-four hours later, there were still three centers. A center which developed south of Kap Farvel, on the 22d, was to become the primary circulation, as the original LOW weakened and raced through the Denmark Strait, and into the Norwegian Sea.

A very minor wave was analyzed, on the 1200 chart of the 27th, off the New England coast, south of the Bay of Fundy. It moved slowly eastward, gradually deepening and increasing its area of influence.

By 1200 on the 30th, the 988-mb LOW was near 47°N, 46°W. There were gale-force reports around the storm, and maximum seas of 16 ft. On the 31st, an upper-air LOW was centered near 48°N, 48°W, and the center of the surface LOW looped counterclockwise under its cyclonic circulation. The pressure gradient remained relatively weak, with no strong winds.

The surface LOW remained directly associated with the upper-air LOW, as it drifted southeastward. On June 3, a deepening trend started. At 1200 on the 4th, a ship reported 40-kn winds northwest of the 982-mb center. Early on the 5th, 35- to 40-kn gales were blowing over the western half of the circulation. At 1200, the GOLDEN ORCHID report was received, with 55-kn winds near 46.5°N, 19.5°W. Compared with other wind reports in the area, this appeared too high, until the wave report was considered. The seas were 38 ft, and the swells, 23 ft. The sky was coded as obscured. The LOW moved northward on the 6th and 7th, losing its upper-air support, and dissipated south of Iceland.

Casualties--The 21,607-ton Norwegian tanker PERIKUM ran aground in heavy rain, at Mile 37 in the Orinoco River. On the evening of the 29th, the 32,306-ton American DELTA MAR and the 24,424-ton Liberian ALKES collided about 90 mi southeast of Port Arthur, Tex., during a thunderstorm.

SMOOTH LOG, JUNE 1975--The number of storm tracks was near normal, and their paths fairly consistent once over the ocean, but they were relatively weak even for this month. The primary track was from the vicinity of Newfoundland through the Denmark Strait. This differed from climatology in that it normally passes south of Iceland. Secondary tracks were from northern Quebec to southern Greenland, and from the west-central ocean (40°N, 60°W) toward the Faeroe Islands. The Great Lakes had their share of storms, as many cyclone paths intersected over or north of Lake Superior. The majority of these dissipated before reaching the ocean.

The central pressures of the pressure centers were very close to their normal values. The 1010-mb low center was displaced some 900 mi east-northeastward of its climatic position: 61°N, 30°W versus 57°N, 60°W. The 1024-mb Bermuda-Azores High was nearly normally located, at 33°N, 37°W. The 1020-mb isobar extended much farther to the east and northeast than normal, stretching to the northwestern coast of Spain and France and encircling the United Kingdom. The pressures were slightly higher than normal over and near the New England coast, and over western and northern Europe.

There were two significant negative anomaly centers, a 3-mb between Iceland and Kap Farvel with the low center, and another, larger 3-mb center over the west-central ocean. The positive areas were along the coasts: a 5-mb near Cape Chidley, a 5-mb over central Greenland, a 6-mb over Scotland, and a 5-mb near the Canary Islands.

At the 700-mb level, a Low was centered over Greenland, with a sharper-than-normal trough off the North American coast. A ridge which is generally west of the European coast was over the United Kingdom and Bay of Biscay. The trough that is normally over Spain was shifted to the western Balkans, with a weak Low off Portugal. A long, narrow ridge extended coast to coast, and into Africa, between approximately 18° and 30°N. The anomalies were not especially significant, being positive near the coasts about 50° and 20°N, and negative over the central ocean and northern seas.

The first tropical cyclone--Amy--formed during the last week of the month.

Extratropical Cyclones--On the 2d, there was a HIGH over the Mississippi Valley, with a front separating it from the Bermuda HIGH. On the 3d, a wave formed on the front over South Carolina. On the 1800 chart, two centers had developed; one moved up the coast to Cape Cod, and the other, eastward to sea. On the 5th, their circulations combined, and, by 1200, only one 993-mb center remained, near 40°N, 58°W. The MANCHESTER VIGOUR (38.5°N, 66.5°W) radioed 40-kn winds and 23-ft seas. Southeast of the center, but behind the cold front, the MINERAL OUGREE (36.5°N, 52.5°W) reported 35-kn gales. At 0000 on the 6th, the HEILBRONN, near 36.5°N, 53.5°W, also reported 35-kn westerly winds and 15-ft southwesterly swells.

By 0000 on the 7th, the 990-mb LOW was at 44°N, 36°W, and the TOYOTA MARU found 35-kn gales near 37°N, 35°W, as did two Soviet ships east of the occlusion. The STATE OF TAMIL NADU, at 43°N, 33°W, was pounding into 50-kn winds, 10-ft seas, and 20-ft swells. Closer to the center, a SHIP (45°N, 28°W) was battered by 50-kn westerlies on her northerly course.

At 1200 on the 8th, two ships sailing south of the center had minimal winds, but reported seas or swells of 26 and 33 ft. They were the ATLANTIC FOREST and KASIMOV. The EXFORD, at 46.3°N, 25.8°W, and about 250 mi south of the center, was pounded by 50-kn winds, 8-ft seas, and hull-shattering 28-ft swells. On the 9th, the LOW deteriorated rapidly and, on the 10th, disappeared.

A front occluded as it moved across the Appalachians, and a LOW formed at the triple point, over Long Island, on the 6th. The EXPORT FREEDOM was at 40°N, 66.9°W, at 1800, in a violent 60-kn storm. At 0000 on the 7th, the LOW was 993 mb near 43°N, 69°W, and the GYPSUM EXPRESS found 45-kn winds south of the Bay of Fundy, just prior to passage of the occlusion. Twelve hours later, VC 8062 had 40-kn gales, and the LOW joined with another system over Maine.

This storm originated over the central Great Plains, moved across Lake Superior and southern James Bay, and was over Newfoundland at 1800 on the 19th. At 1200, the VC 8062 drilling ship reported 40-kn gales near 44°N, 58°W. The central pressure of the LOW was 982 mb, at 0000 on the 20th, at 51°N, 52°W. The C. S. ALERT was headed northeastward with 40-kn beam winds. The LOW was moving northeastward only slightly faster than the ALERT. At 1200, the ALERT suffered 50-kn south-southeasterly winds on her easterly heading. Seas of 28 ft were pounding against her starboard beam. The LOW, at 976 mb, was tracking more northerly, at 0000 on the 21st, and the ALERT was maintaining nearly the same position relative to the center. She continued receiving 50-kn winds. On this observation, the seas were 26 ft, and the swells 16 ft. The SKAFTAFELL, at 53°N, 46°W, was plotted as 95 kn, but may have been in error as many elements were missing, and the gradient did not appear to support that wind value.

The LOW continued a north-northeasterly track, with only isolated minimum gale-force reports. At 1200 on the 22d, the BASHKIR, near 64°N, 07°W, had 40-kn gales.

On the 23d, the LOW split into two centers astride Iceland, and the original one disappeared.

A large waterspout (fig. 28) occurred off Key West, Fla., on the 21st.

This LOW tracked eastward from Hudson Bay. It moved over the Labrador Sea, on the 27th, and was probably producing gale-force winds, but there were no ship reports in the area. At 0000 on the 28th, the 990-mb storm was approaching Kap Farvel. To the south, off Trinity Bay, the HAVDRILL measured 35-kn winds and 12-ft seas. On the 29th, at 0000, the NELLA DAN was off Angmagssalik, Greenland, with rain and snow showers and 40-kn winds. The LOW was moving up the east coast of Greenland through the Denmark Strait and rapidly weakening.

Tropical Cyclones--During the period June 24 through 26, a weak surface trough of low pressure persisted over Florida and the adjacent Atlantic waters. A weak

Figure 28.--These small boats are dwarfed by the large waterspout. The base of the clouds was about 3,500 ft. No damage was reported from the violent vortex. Wide World Photo.

circulation formed off the Florida east coast, just north of the Bahamas, by the evening of June 26. The tropical depression moved northward at about 9 kn, during June 27, with a lowest pressure around 1012 mb and highest winds of 22 to 26 kn. The development of a well-organized, warm anticyclone in the upper atmosphere during the early stages of this system contributed to its rather rapid strengthening into tropical storm Amy, on the 29th. The storm skirted the North Carolina coast, and the area of maximum winds and heaviest rainfall remained over the open waters of the Atlantic. Some of the ships that reported high winds and waves were: CHICAGO, 55 kn; DALLAS, 60 kn and 30 ft; DART AMERICA, 50 kn; EXXON HUNTINGTON, 50 kn; JOHN TYLER, 40 kn and 25 ft; KLEK, 60 kn; RODRIGES CABRILHO, 55 kn; and SAN JUAN, 60 kn and 30 ft.

From June 29 to July 3, Amy moved on a meandering east-northeasterly course, with an average forward speed of less than 9 kn. On both July 1 and 2, minor troughs in the westerlies caused Amy to slow

and turn to a more northerly course, with brief threats to the Canadian Maritime Provinces. On the 3d, a major trough developing over southeastern Canada produced a rapid northeasterly acceleration, with the center of Amy passing some 150 mi southeast of Cape Race, Newfoundland, on the 4th. The high winds and rains associated with the storm did not affect Newfoundland, and the system gradually lost all its tropical characteristics over the cold waters of the far North Atlantic.

Damage produced by tropical storm Amy was light and confined to erosion along the Outer Banks of North Carolina. Tides of 2 to 4 ft above normal, caused by prolonged northeasterly winds and combined with large swells associated with the circulation of Amy, damaged many of the beaches. Some State highways near the beach were temporarily under water. Rainfall of 2 to 4 in occurred along the immediate coast of North Carolina, but was much lighter inland.

During most of its life, Amy had many of the characteristics of a subtropical storm. The region of maximum winds was well removed from the center, and midtropospheric temperatures were not as warm as might be expected in a tropical storm. The minimum pressure was 981 mb, but the maximum sustained winds of 60 kn were less than might be expected with this pressure. However, when the LOW attained winds of gale force, data indicated it was more tropical than subtropical, so it was named Amy. Because of the proximity to the coast, the name was retained throughout to avoid confusion in public releases.

Casualties--The WILLIAM R. ADAMS (10,713 tons) and the IPSWICH PIONEER II collided in fog at Harwich Harbor, England, early on the 6th.

Smooth Log, North Pacific Weather

May and June 1975

SMOOTH LOG, MAY 1975--The paths the storms traversed this month followed the climatological pattern. The number was above normal, and the pressures generally deeper. The majority originated south of Japan, traveled northeastward to the Aleutian Islands, and paralleled them into the Gulf of Alaska. During the latter part of the month, the storms tended to originate and track farther south across the midocean. There also were more individual cyclones the last half of the month.

The main feature of the mean sea-level pressure pattern was the Pacific High. It was normally located, with two centers, the eastern-most one being about 3 mb higher in pressure than normal, with a sharper ridge extending farther up the North American west coast. The Aleutian Low was about 3.5 mb lower in pressure and centered much farther east than normal, south of the Shumagin Islands rather than north of the Near Islands. There was an anomalous High over the Sea of Okhotsk, which is normally under the influence of the Aleutian Low.

The primary negative anomaly center was 7 mb and colocated with the misplaced Aleutian Low. A large area of slightly negative values was located between 20° and 30°N, from south of Japan to 165°E. The High over the Sea of Okhotsk produced a positive 7-mb anomaly. The higher pressure of the eastern part of the Pacific High, plus the more intense ridging northward, resulted in a positive 5-mb anomaly center off the California coast.

The primary difference between climatology and the monthly mean 700-mb height pattern was in the location of the centers. Both the LOWs and HIGHs were shifted eastward from their climatic positions. Their central values were also lower and higher, respectively. The primary wind flow was zonal, with a short-wave trough off the Japanese coast and a ridge over the North American west coast.

There were no tropical cyclones this month. The averages show one can be expected each 2 yr in the eastern ocean, and three every 2 yr in the western ocean.

Extratropical Cyclones--Monster of the Month--The first significant storm of this month developed east of Hokkaido and south of Ostrov Simushir, on the 5th. It moved east-northeastward as an oval circulation, as it pushed against a HIGH over the central ocean. It was not until 0000 on the 7th, that gale-force winds were reported. At that time, the 974-mb storm was near 51°N, 171°W. The MIDAS RHEIN, at 49.5°N, 168.3°W, was sailing into 50-kn winds and 16-ft seas. To the south, near 46°N, 166°W, the HOSOSHIMA MARU was experiencing 40-kn gales. At 0600, the PHILIPPINE MAIL had 50-kn winds and 23-ft waves, at 46.3°N, 169.1°W.

At 1200 on the 7th, the MONTIGNY (49°N, 167°W) was banged by 50-kn winds and 20-ft seas and swells on her port side. The PHILIPPINE MAIL (46°N, 166°W) had 45 kn on her stern, with 23-ft swells. Further around the circulation, the CHINA BEAR (44°N, 161°W) was racing at 20 kn, with 40-kn winds and 18-ft seas and swells.

At 0000 on the 8th, the 968-mb LOW was near 50°N, 151°W. The winds had picked up to 55 kn for the CHINA BEAR, which was now at 44°N, 156°W. The seas and swells were 25 ft. The AMERICAN LYNX was on the southwest perimeter of the circulation, with 40-kn winds and 28-ft seas. Gales of 40 kn were blowing in all quadrants. At 1200, two ships reporting these winds were the PHILADELPHIA and the PORTLAND. At 0000 on the 9th, the LOW was slightly south of OWS PAPA, at 982 mb. The HARBOUR BRIDGE was at 50.8°N, 136.9°W, and measured 40 kn from the southeast. Waves of 20 to 25 ft were a common sight in the southern half of the storm. At 0600, the J. H. TUTTLE (52.2°N, 153.2°W) found 55-kn storm winds.

On the 8th, the storm had turned southeastward. On this track, it was gradually weakening, as it and a branch of the Pacific High gradually eroded each other.

This LOW formed in the wake of the previous storm, on the 7th, near 44°N, 158°E. At 0600 on the 8th, the CHALMETTE measured, and felt the wrath of, 62-kn winds at 50.6°N, 168.8°E. The storm moved over the Near Islands, about 1800 on the 8th, at 985 mb. As the 1200 on the 10th, the DAIAN MARU was south of the Rat Islands with 40-kn gales, 13-ft seas, and 20-ft swells. At 0000 on the 11th, the BRITISH PATIENCE, south of Tanaga Island, recorded 45-kn gales, with 26-ft seas and swells.

After the LOW entered the Gulf of Alsaka, the pressure started to rise. The BAY BRIDGE was about 200 mi south of the center, with 40-kn winds. Eight hundred miles southeast of the center (44°N, 137.5°W), the ZENLIN GLORY was sailing into a 50-kn storm.

Late on the 11th, the LOW turned southward; on the 13th, it curved back toward the north; and dissipated on the 14th.

This storm came out of the East China Sea on the 9th. It raced eastward south of Japan, until turning northeastward on the 10th. At 0000 on the 11th, the IBERVILLE was near 36°N, 157.5°E, and about to cross the cold front westbound. The winds were 40 kn, with 12-ft waves. Late on the 11th, the storm turned northward in response to another surface LOW over Mys Loptaka, and the upper-air LOW. The two surface systems combined, on the 12th, and again turned eastward. At 0000, a ship reported 40-kn gales south of the center, at 41°N. The ASIA BEAUTY was at 52.6°N, 175.9°E, at 0600 on the 13th, and measured 48-kn winds. The INDIAN MAIL, at 49.9°N, 166.5°E, contended with 26-ft swells. Most of the wind reports were still minimal gales, but the seas were building, on the 13th. At 0000 on the 14th, the 984-mb LOW was near 52°N, 179°E, and moving southeastward to cross the Aleutians southbound. The SUSONG was far to the south of the center, near 44°N, 173°E, with 30-ft seas and 36-ft swells from the west on her starboard bow. On the 15th, the WASHINGTON reported 35-kn gales and 23-ft waves.

As the storm moved toward the Gulf of Alaska, it deteriorated rapidly and disappeared from the analysis, near Sitka, on the 18th.

This cyclone had extreme longevity, existing for 17 days over the Pacific. The storm came out of the Yellow Sea, on the 13th, and slowly tracked south of Japan. It took 4 days to make the voyage and develop into a significant LOW. On the 18th, it had a 990-mb center near 38°N, 150°E. The PACIFIC ARROW was near 36.5°N, 148°E, with 40-kn gales. The VAN FORT measured 45 kn at 41.3°N, 150.5°E. The PLUVIUS had only 42-kn winds, but the seas were 17 ft, and the swells, 23 ft. On the 19th, the DAISHIN MARU and OGDEN AMAZON had 40- and 45-kn gales, respectively, north of the center.

As the storm moved southeastward, it weakened, and it appeared that it might dissipate, but, on the 21st, it swung northeastward and again intensified. At 0000 on the 22d, the BLUE SKY was northwest of the center, with 45-kn winds and 16-ft waves. Southwest of the center, the PLUVIUS, which was traveling eastward with the storm, had 48-kn winds, 20-ft seas, and 30-ft swells, on the 21st; and 44-kn winds, 20-ft seas, and 26-ft swells, on the 22d.

On the 23d, a HIGH, which had been centered northwest of the LOW's center, squeezed north of the cyclone to join a HIGH off the California coast. This slowed the LOW's movement nearly to a standstill. After passage of the HIGH, the LOW raced northward. The J. H. TUTTLE was near 52°N, 150°W, with 45-kn winds, and OWS PAPA had 40 kn, with high seas.

On the 25th, as the storm appeared ready to enter the Gulf of Alaska, it changed course toward the northwest. The CHEVRON HAWAII reported departing Cook Inlet with 50-kn winds on her port side, at 1200, and had 55-kn winds, with 13-ft seas and 20-ft swells, at 1800. The 3,384-ton barge KEVALASKA capsized in heavy seas in Kachemak Bay, Alaska. The deck cargo was lost. The barge was later reported near Homer Spit. On the 26th, the storm stalled near Unimak Island, and finally dissipated on the 29th.

This was the third of three severe storms that were generated in this area: one each 5 days--8th, 13th, and 18th. As with the others, this LOW traveled south of Japan and, by 1200 on the 20th, was 973 mb at 41°N, 151°E. The LOTUS was washed by heavy rain and 35-kn winds, about 100 mi northeast of the center. At 0000 on the 21st, the EASTERN BUILDER, near 42°N, 152°E, was headed directly into 50-kn winds, 13-ft seas, and 25-ft swells, as she passed slightly east of the center. Gales were blowing all around the center. A ship was plotted near the occlusion as 70 kn, but the seas indicated this was probably a transmission error.

On the 22d, the VAN CONQUEROR measured 48-kn winds at 42.9°N, 156.1°E. The YAMATADA MARU, sailing northeastward near 43°N, 153°E, had 30-kn winds on her port side, with pounding 21-ft seas and 31-ft swells. To the east, at 41°N, 160°E, the DAISHOWA VENTURE was sailing into 35-kn winds, with 23-ft swells. Twelve hours later, the YAMATADA had moved only about 100 mi and still had 20-ft seas and 30-ft swells.

The LOW moved south of the Aleutian Islands with a central pressure around 996 mb. The pressure gradient was comparatively weak, with only a few minimal gales reported. On the 25th, it was tracking southeastward as it moved around the circulation of the LOW that stalled over Unimak Island. By 1200 of that day, it had been absorbed by the older system.

This was a western ocean storm. It started as one of a series of frontal waves on a stationary front, south of Honshu, on the 24th. On the 25th, it was 1007 mb, southeast of Tokyo. The SHUHKOKU MARU was near 36°N, 149°E, with 40-kn easterlies, 8-ft seas, and 18-ft swells. The LOW was moving northeastward and, on the 26th, was 996 mb near 40°N, 149°E. The ATLANTIDE, at 39.5°N, 148°E, had 54-kn winds, with waves less than 12 ft. On the 27th, the storm turned northward and weakened rapidly, dying over the Kuril Islands on the 28th.

Casualties--The 1,770-ton Japanese-registered CORAL ROSE, with a cargo of fish, went aground near 23.8°N, 67.5°E, in bad weather, and was abandoned by the crew.

SMOOTH LOG, JUNE 1975--The number of cyclones traversing the North Pacific appeared near to slightly above normal. The primary paths were normally located over the western ocean, but had a more easterly orientation. Climatically, the primary paths stretch from Japan to the Aleutians at 180°. From there the track parallels slightly south of the islands into the Gulf of Alaska. Another path comes out of the central ocean into the Gulf. This month's primary track was east-northeasterly from Japan to near 160°E, where it split; one segment followed the traditional path toward Adak Island, and the other moved eastward to 170°W, and then followed the climatic midocean path into the Gulf of Alaska.

The Pacific High was even more the dominant feature this month. It was near 39°N, 144°W, at 1029 mb, about 300 mi northeast of its 1022-mb climatic position. The area of low pressure is an east-west-oriented trough over the Bering Sea according to climatology, but this month there was a 1011-mb center near 50°N, 180°, and a 1010-mb center near Bethel, Alaska. The pressure along the Asian coast was slightly lower, and along the North American (other than Alaska) slightly higher, than normal.

The chart was fairly confused except over the eastern ocean. A plus 6-mb departure center was near 42°N, 134°W. A plus 3-mb center was south of Kamchatka. There was a negative 4-mb center in midocean, near 47°N, 179°W, and another negative 4-mb center over southern Japan.

The upper-air pattern at 700 mb closely resembled the climatic pattern in height and configuration. The significant difference was a deeper, sharper trough in the vicinity of 180°.

There were two tropical cyclones over the eastern North Pacific--hurricane Agatha and tropical storm Bridget.

Extratropical Cyclones--The North Pacific was very quiet this month, and especially so if you discount the two tropical cyclones in the eastern waters.

This storm formed as a wave on a front in midocean. It circled around an older LOW moving toward the Gulf of Alaska and, at 1200 on the 1st, was 994 mb near 42°N, 169°W. By 0000 on the 3d, the 988-mb LOW was at 52°N, 161°W. Southeast of the center, the HAKKAI MARU reported 35-kn winds and 16-ft swells. Twenty-four hours later, the LOW had traveled to 54.5°N, 153.5°W. The ROBERT BANKS (52°N, 151°W) and the CHIKUGO MARU (49°N, 153°W) were cruising in 40-kn winds, with seas and swells up to 16 ft. The DAISHIN MARU fared slightly better, with 35-kn winds and 10-ft seas near 50.5°N, 149°W. Far to the east near the coast (53°N, 135°W), the NEWARK also suffered 35-kn winds and 8-ft seas.

The LOW started filling and, on the 5th, turned northward. It was barely moving northwestward when it disappeared on the 6th.

Like the previous storm, this one formed in midocean, but farther south. It had its beginning as a 1015-mb center near 32°N, 179°W. It developed a circulation which, by 0000 on the 6th, covered over 700 mi in diameter. At the same time on the 7th, the 996-mb LOW was near 44°N, 161°W. The CURACO MARU was near 39.5°N, 161°W, with 45-kn winds and 15-ft waves. This was the highest extratropical wind plotted on the charts this month for this ocean. Other ships recorded winds as high as 45 kn, but did not make the chart deadline for plotting. They came to light when the observation form was forwarded to the National Climatic Center. The ZIM TOKYO fought 45-kn winds, at 0600, about 200 mi south of the center.

As most storms in this area of the Pacific do, this LOW also traveled toward the Gulf of Alaska. At 0000 on the 8th, the 990-mb LOW (50.5°N, 156°W) brought 35-kn winds to the REXTAR, near 50°N, 151°W. By the 9th, the storm was curving northwestward, and the J. H. TUTTLE battled 45-kn winds and 15-ft seas. The storm dissipated, on the 10th, near the Alaska Peninsula.

This LOW formed on the triple point of an occlusion, near 39°N, 164°E, on the 8th. A ship northeast of the center radioed 35-kn winds and 13-ft waves at that time. The 990-mb LOW was moving northeastward, and the PAPYRUS MARU encountered 40-kn winds, near 42.5°N, 171°E, ahead of the newly formed occlusion. On the 9th, the EASTERN KIKU had 35-kn gales, again ahead and east of the front where the stronger winds were blowing. Later reports indicated 40-kn winds, with seas up to 16 ft, south and southeast of the center.

On the 9th and 10th, and early on the 11th, the surface LOW moved eastward under the influence of the upper-air circulation. The KIZAN MARU, 100 mi west of the center, and the SEA-LAND EXCHANGE, 240 mi northeast of the center, were both hit by 40-kn winds. At 0000 on the 11th, the JAPAN MAIL, near 43.5°N, 177°W, had 40-kn northwesterlies and only 7-ft seas, but 21-ft swells.

Although this was not a particularly deep LOW, it had a large circulation. The J.H. TUTTLE, south of the Shumagin Islands, found 35-kn gales. The RYOKO MARU, south of the center at 40.5°N, 166°W, had 16-ft swells.

As the storm approached the Gulf of Alaska, it lost its main upper-air support and started to deteriorate. On the 14th, it no longer existed.

The Pacific HIGH migrated northwestward, starting about the middle of the month. It settled near 43°N,

155°W, as a gross location. This blocked the eastward movement of cyclones beyond about 165°W. Later in the month, the HIGH was slowly retreating southeastward. A weak frontal wave managed to move into the Gulf of Alaska, where the gradient was already relatively weak. On the 24th, a 1004-mb LOW was evident. The GRAND GLOBE, near 54°N, 152°W, was sailing into 35-kn northwesterly winds. On the 25th, the ASIA BOTAN was headed into 40-kn winds and 16-ft seas and swells.

The LOW remained essentially stationary and slowly filled, leaving only a weak gradient along the coast on the 26th.

This was one of the cyclones diverted northward by the large HIGH over the eastern ocean, late in the month. It started as a frontal wave, east of Tokyo Bay, late on the 24th. It moved eastward as a weak 1000-mb LOW, slowly spreading its influence until early on the 27th. At that time, it was pushing against the HIGH and moving into southerly upper-air winds around the upper-air LOW, which was near 50°N, 180°. On the 27th and 28th, it raced northward to cross the Aleutians at 170°W, at 1800. On crossing the islands, it braked to a crawl as the 982-mb LOW moved away from the upper-air LOW. The J. H. TUTTLE found 35- and 40-kn winds north of the islands, near 56°N, 167°W, on the 18th and 19th. Unimak Island measured 35-kn gales. On the 30th, Cape Romanzof measured 40-kn gales. On the 1st, the storm disappeared as it crossed the Bering Strait.

Tropical Cyclones, Eastern Pacific--A number of tropical disturbances were charted in the eastern North Pacific Ocean during the last 2 wk of May, but the areas of squalls and thunderstorms would build, die, and rebuild several hundred miles from the initial point, on successive days.

An area about 250 mi southwest of Acapulco showed signs, on June 1, of greater instability than the others. Windspeeds of 25 kn were reported by the PRESIDENT JEFFERSON, at 15.1°N, 97.3°W, at 1800. At 0000 on the 2d, the SHUNYO MARU reported an eastsoutheasterly 25-kn wind and a 1005.4-mb pressure in the same area. No other vessels reported in the area, but the 2345 Synchronous Meteorological Satellite (SMS-2) photograph indicated a tropical depression with 30-kn winds, close to 13.5°N, 99°W. Film loops showed its movement to be toward the westsouthwest at 12 kn. The LOW was forecast to curve westward and then northwestward, and to intensify.

When the depression reached its southernmost point, near 13.1°N, 100.4°W, at 0600 on the 3d, it increased to tropical storm intensity with 35-kn winds and was named Agatha. Further intensification took place, with winds increasing about 5 kn each 6 hr through 1800 on the 3d, during which time the storm traveled on a northwesterly course at a speed of about 10 kn. A 2116 satellite picture showed development to hurricane intensity near 15.4°N, 103.7°W, about 150 mi southwest of Zihuatanejo, with 65-kn winds and gales out 250 mi in the northeast quadrant and 125 mi elsewhere.

The strongest winds suggested by satellite pictures were 70 kn, at 0000 on the 4th. The hurricane continued into the night, but decreased to a tropical storm at 1200. An apparent jog in the track was the result of the difference in the location of the center between nighttime infrared- and daytime visible-spectrum pictures.

After analyzing all the data and forming the "most probable track" of the storm, it was decided that the northeasterly movement was probably indicated as a result of a slight error in the storm's location, at 0600 and 1200 on the 4th. These errors were translated to the forecast, which then placed the storm onshore near Puerto Vallarta, about 0600 on the 6th. At 1800 on the 4th, a new track was developed, with the storm continuing northwestward from near 18°N, 105°W.

Agatha weakened to a tropical depression at 1200 on the 5th. At 1800, the center was analyzed at 19.3°N, 106.4°W, based on 20- to 25-kn winds reported by the J.V. CLYNE, the MELVILLE, and the NORDIC HERON. The storm dissipated about 120 mi south of the Tres Marias Islands.

A tropical depression developed about 500 mi south of the tip of Lower California, well west of the usual formation zone for tropical cyclones in the eastern North Pacific Ocean, at 1800 on June 27.

As usual, initial movement of the depression was uncertain, but a general westerly direction was followed at a speed of 6 kn for the first 12 hr. When the depression intensified to tropical storm Bridgett, near 15°N, 111°W, at 1200 on the 28th, its course changed to northwesterly, and the speed increased to 8 to 10 kn. This movement continued as gradual intensification took place. The KOPAA, heading southeastward, sailed southwest and south of the center, on the morning of the 29th, when Bridgett had 50-kn winds. The highest windspeed the KOPAA reported was 25 kn, at 1800 on the 29th and at 0000 on the 30th.

Bridgett changed to a westerly course at 17.3°N, 115°W, after the KOPAA passed, and then southwesterly, approaching no other vessel as a storm. The CHAOMING outran the storm westbound, on July 1 and 2, reporting regularly as she traveled.

At 0600 on the 2d, Bridgett became a depression, near 15°N, 120°W, with 30-kn winds. Continued cloudiness, somewhat supported by reports from fishing vessels in the area, indicated that a circulation remained for several days near 14.4°N, 122.5°W, but there were insufficient data to warrant upgrading the circulation to tropical depression status.

Casualties--The 231,799-ton Japanese supertanker EIKO MARU ran aground, in poor visibility of 1.2 km in Tokyo Bay, while trying to avoid collision with another ship on the 4th. On the 20th, the Japanese submarine OYASHIO and 1,573-ton GOSHU MARU collided in the Inland Sea during dense fog.

The 4,607-ton Somalian-registered EASTERN VENUS sank, on June 30, due to a fractured hull sustained during stormy weather in the Arabian Sea, near 18°N, 61.1°E.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

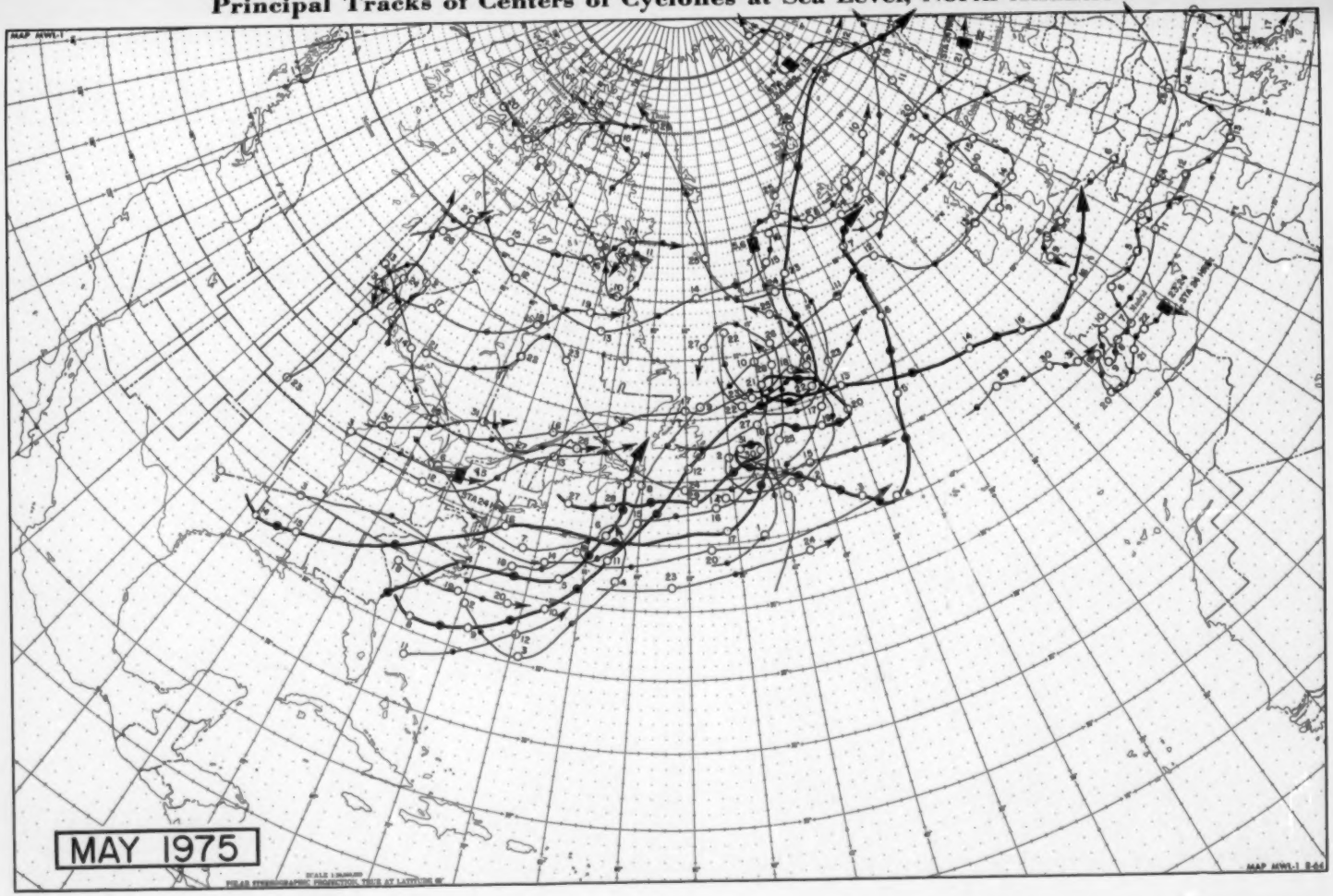


Figure 29.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

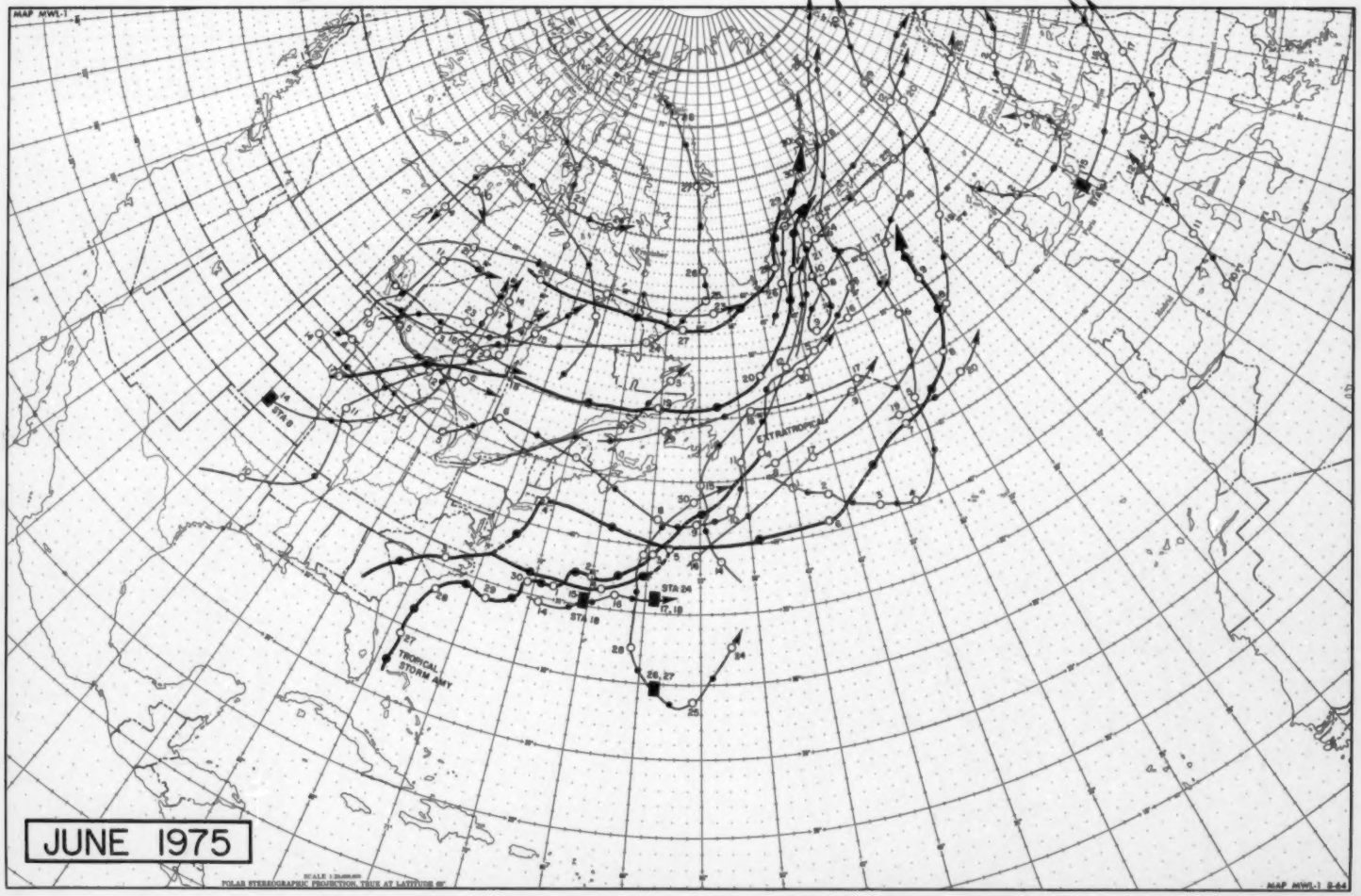


Figure 30.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Figure 30.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

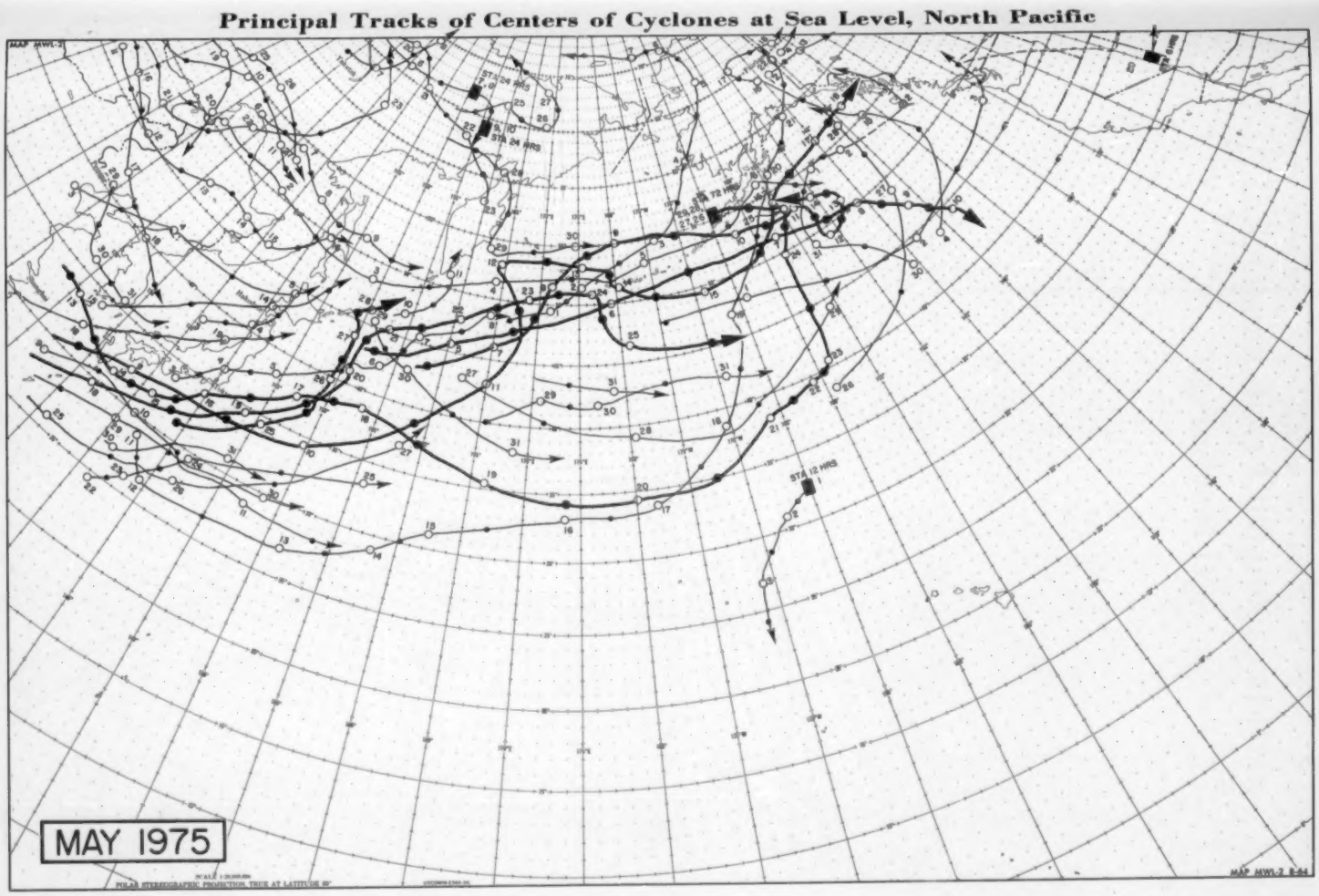


Figure 31.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

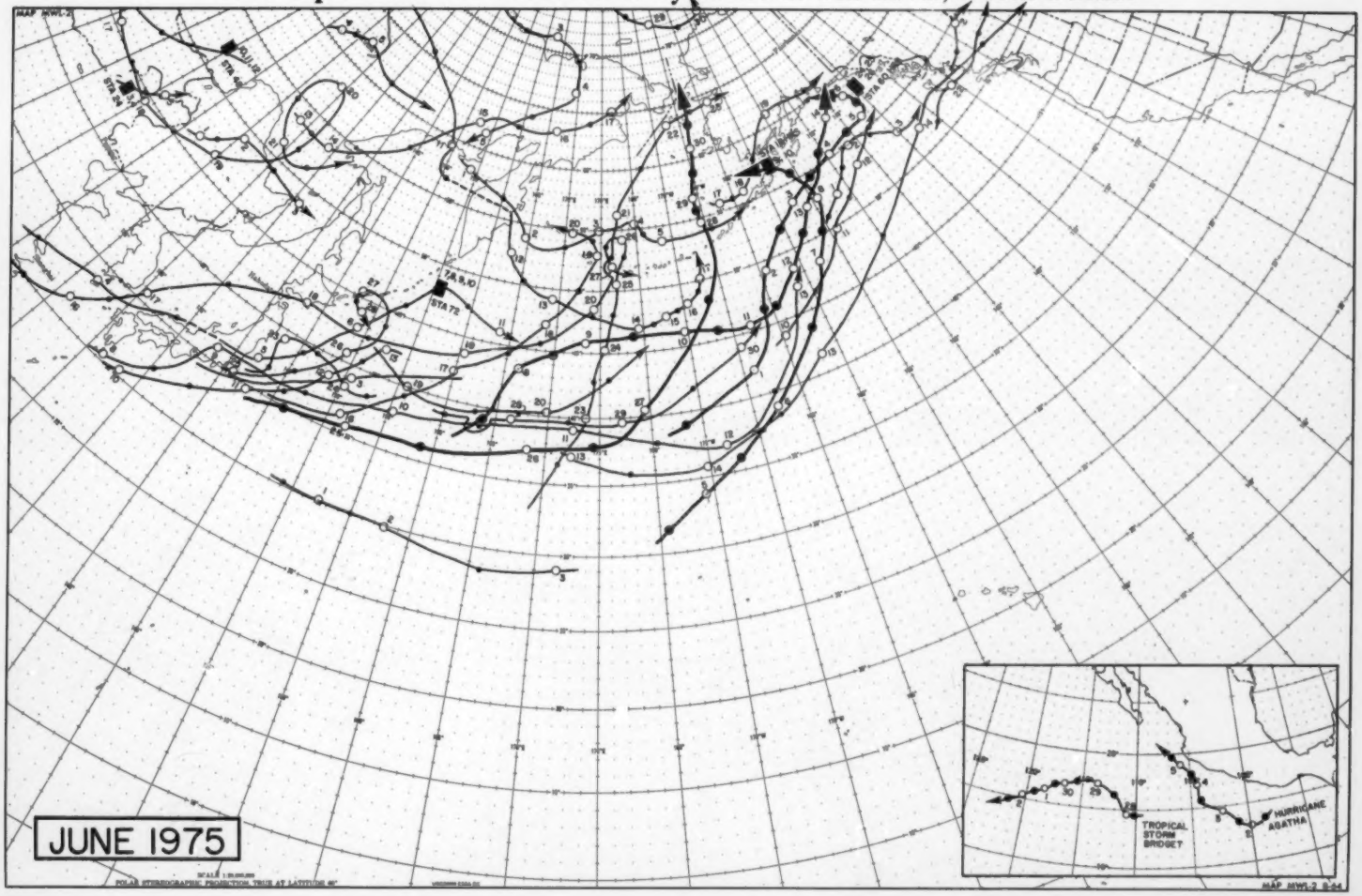


Figure 32.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Table 4
U.S. Ocean Buoy Climatological Data
May and June 1975

MAY — DATA SUMMARY — E003

AVERAGE LATITUDE 56.0N — AVERAGE LONGITUDE 147.9W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	03.4	(22 18)	08.4	13.1	(30 00)	247	31
DEWPOINT TEMP (DEG C)	-03.6	(22 06)	02.7	09.5	(31 18)	247	31
PRESSURE (MBAR)	0995.0	(17 03)	1007.8	1020.7	(30 09)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

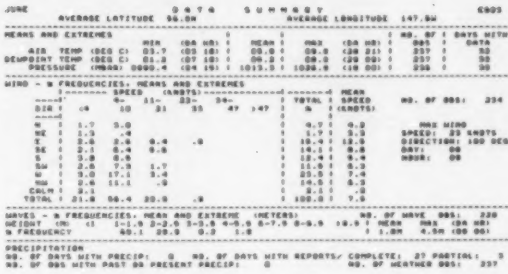
DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		2.4	1.6				4.0	8.7
NE	.4	.4	2.0	.4			3.2	10.4
E	.4	1.6	10.2	5.3			26.1	18.1
SE	.4	0.8	12.9	1.2			23.1	12.2
S	1.6	6.1	5.3	.4			13.4	9.6
SW		4.0	2.0				6.1	9.3
W	.8	5.3	10.1				16.2	10.8
NW		4.0	4.9				8.9	10.7
CALM	.4						.4	.0
TOTAL	4.0	32.8	54.3	8.9			100.0	13.8

MAX WIND: SPEED: 52 KNOTS; DIRECTION: 110 DEG; DAY: 25; HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 243

HEIGHT (M)	<1	1-1.9	2-2.9	3-3.9	4-4.9	5-7.9	8-9.9	>9.9	MEAN	MAX	(DA HR)
% FREQUENCY		34.7	57.2	16.9	11.6				2.4M	9.5M	(25 06)

PRECIPITATION
NO. OF DAYS WITH PRECIP: 25 — NO. OF DAYS WITH REPORTS/ COMPLETE: 30 PARTIAL: 1
NO. OF OBS WITH PAST OR PRESENT PRECIP: 189 — NO. OF WEATHER OBS: 247



JUNE — DATA SUMMARY — E003

AVERAGE LATITUDE 56.0N — AVERAGE LONGITUDE 147.5W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	03.5	(03 18)	08.8	13.8	(28 21)	237	30
DEWPOINT TEMP (DEG C)	01.8	(07 18)	06.2	08.9	(28 09)	237	30
PRESSURE (MBAR)	0999.4	(24 15)	1013.9	1030.9	(10 00)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

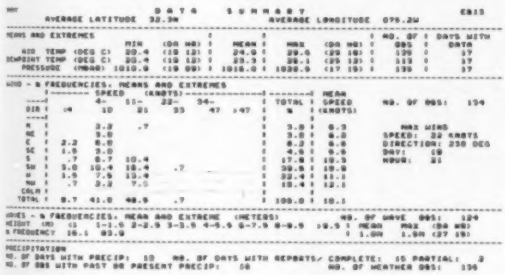
DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.7	5.0					6.7	8.2
NE	1.3	.4					1.7	5.3
E	2.6	2.6	6.4	.8			12.4	12.5
SE	2.1	0.4	9.8				12.1	9.8
S	3.8	0.8					12.4	8.4
SW	2.6	7.9	1.7				11.9	8.3
W	9.0	17.1	3.4				23.5	7.4
NW	2.6	11.1	.8				14.5	6.3
CALM	2.1						2.1	.0
TOTAL	31.8	56.4	20.9	.8			100.0	7.9

MAX WIND: SPEED: 23 KNOTS; DIRECTION: 190 DEG; DAY: 08; HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 220

HEIGHT (M)	<1	1-1.9	2-2.9	3-3.9	4-4.9	5-7.9	8-9.9	>9.9	MEAN	MAX	(DA HR)
% FREQUENCY		40.1	28.9	9.0	1.8				1.8M	4.5M	(09 06)

PRECIPITATION
NO. OF DAYS WITH PRECIP: 0 — NO. OF DAYS WITH REPORTS/ COMPLETE: 27 PARTIAL: 3
NO. OF OBS WITH PAST OR PRESENT PRECIP: 0 — NO. OF WEATHER OBS: 237



MAY — DATA SUMMARY — E813

AVERAGE LATITUDE 32.3N — AVERAGE LONGITUDE 075.2W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	20.4	(12 12)	24.9	29.0	(29 18)	139	17
DEWPOINT TEMP (DEG C)	20.4	(15 12)	23.3	26.1	(25 12)	113	17
PRESSURE (MBAR)	1010.9	(19 09)	1016.0	1020.9	(17 15)	139	17

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		3.2	.7				3.8	6.3
NE		5.0					5.0	6.2
E	2.2	8.6					8.2	6.6
SE	1.5	3.0					4.5	5.5
S	.7	0.7	10.4				17.9	10.5
SW	5.0	10.4	15.4	.7			30.5	10.8
W	1.5	7.5	13.4				22.4	11.1
NW	.7	3.2	7.5				10.4	12.1
CALM							.0	.0
TOTAL	9.7	41.0	48.9	.7			100.0	10.1

MAX WIND: SPEED: 32 KNOTS; DIRECTION: 230 DEG; DAY: 19; HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 129

HEIGHT (M)	<1	1-1.9	2-2.9	3-3.9	4-4.9	5-7.9	8-9.9	>9.9	MEAN	MAX	(DA HR)
% FREQUENCY	16.1	83.9							1.0M	1.5M	(27 15)

PRECIPITATION
NO. OF DAYS WITH PRECIP: 10 — NO. OF DAYS WITH REPORTS/ COMPLETE: 15 PARTIAL: 2
NO. OF OBS WITH PAST OR PRESENT PRECIP: 58 — NO. OF WEATHER OBS: 136

JUNE — DATA SUMMARY — E813

AVERAGE LATITUDE 32.5N — AVERAGE LONGITUDE 075.2W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	21.4	(03 12)	25.9	30.7	(14 21)	220	29
DEWPOINT TEMP (DEG C)	17.1	(22 06)	23.3	26.9	(01 21)	218	29
PRESSURE (MBAR)	1008.0	(07 21)	1017.4	1029.9	(23 18)	220	29

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	.8	.4				1.3	9.4
NE		5.0	.9				6.0	8.7
E		4.4	11.5	5.1			10.8	16.4
SE	.4	3.7	14.2	.8			18.1	14.1
S	.8	.8	0.3	.8			0.2	13.7
SW	.8	11.1	13.3	1.8			27.0	11.9
W	1.1	7.5	8.9	4.8			18.2	12.2
NW	.4	3.8	.8				4.8	7.8
CALM	.4						.4	.0
TOTAL	3.8	31.0	90.0	10.8			100.0	12.9

MAX WIND: SPEED: 30 KNOTS; DIRECTION: 220 DEG; DAY: 29; HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 213

HEIGHT (M)	<1	1-1.9	2-2.9	3-3.9	4-4.9	5-7.9	8-9.9	>9.9	MEAN	MAX	(DA HR)
% FREQUENCY	21.1	64.8	22.8	1.8					1.3M	3.0M	(29 09)

PRECIPITATION
NO. OF DAYS WITH PRECIP: 14 — NO. OF DAYS WITH REPORTS/ COMPLETE: 28 PARTIAL: 1
NO. OF OBS WITH PAST OR PRESENT PRECIP: 29 — NO. OF WEATHER OBS: 220

JUNE — DATA SUMMARY — E810

AVERAGE LATITUDE 27.5N — AVERAGE LONGITUDE 088.5W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	23.4	(26 21)	27.6	30.4	(30 00)	106	26
DEWPOINT TEMP (DEG C)	21.0	(27 15)	23.5	25.6	(11 00)	105	25
SEA TEMP (DEG C)	27.2	(10 03)	28.6	30.5	(22 00)	100	24
AIR-SEA TEMP (DEG C)	-06.0	(23 00)	-01.1	01.9	(13 18)	100	24
PRESSURE (MBAR)	101.8	(00 00)	1018.5	1021.9	(24 15)	106	29

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.5	3.8				5.1	4.7
NE		2.3	3.8				5.8	6.4
E		4.8	8.7	0.1			10.0	7.4
SE		4.1	10.2	12.2			26.5	0.3
S		2.0	10.2	7.7			10.0	0.0
SW		0.8	9.8	2.1			10.5	0.0
W		1.3	1.9	.9			5.6	0.7
NW		2.8	.9				5.1	2.8
CALM		1.5					1.5	.0
TOTAL		20.0	44.0	26.0			100.0	7.3

MAX WIND: SPEED: 19 KNOTS; DIRECTION: 140 DEG; DAY: 10; HOUR: 15

PRECIPITATION
NO. OF DAYS WITH PRECIP: 6 — NO. OF DAYS WITH REPORTS/ COMPLETE: 22 PARTIAL: 3
NO. OF OBS WITH PAST OR PRESENT PRECIP: 9 — NO. OF WEATHER OBS: 190

Figure 32.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Table 5
Selected Gale and Wave Observations, North Atlantic
May and June 1975

Vessel	Nationality	Date	Position of Ship: Lat. deg.	Position of Ship: Long. deg.	Time GMT	Wind: Dir.	Wind: Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb	Temperatures °C: Air	Temperatures °C: Sea	Sea Waves*: Period sec.	Sea Waves*: Height ft.	Swell Waves: Dir.	Swell Waves: Period sec.*	Swell Waves: Height ft.
NORTH ATLANTIC		MAY															
LIGHTNING	AMERICAN	1	41.0 N	55.1 W	18	33	35	9	NM	02	1008.1	10.9	10.0	2	6.5	36	8	24.5
SEALAND MARKET	AMERICAN	1	40.8 N	60.8 W	00	33	40	1	NM	91	1007.0	9.7	17.8	6	8	29	10	18
AMER ALLIANCE	AMERICAN	1	41.4 N	58.3 W	18	36	40	5	NM	02	1009.1	5.0	14.5	5	14.5	01	10	24.5
PERNDALE	NORWEGIAN	2	40.6 N	51.8 W	12	34	42	5	NM	80	997.)	9.0	19.0	7	16.5			
MEDNIA	DANISH	2	41.8 N	52.8 W	06	19	M 40	5	NM	80	1006.9	10.6		6	16			
SEALAND MC LEAN	AMERICAN	2	42.6 N	33.5 W	12	17	35	5	NM	07	1006.9	10.2	13.9	4	8	19	12	14.5
SAN JUAN	AMERICAN	2	39.7 N	56.2 W	18	36	35	10	NM	02	1010.9	9.8	17.8	4	5	36	8	6.5
AMER ACE	AMERICAN	2	40.3 N	52.5 W	18	30	40	2	NM	07	1007.0	12.7	11.6	4	11.5	30	< 6	16.5
AMER LEGEND	AMERICAN	2	40.3 N	32.4 W	00	14	36	2	NM		1005.0	13.0	12.2	8	8	18	X	13
AMER ARCHER	AMERICAN	2	40.4 N	31.8 W	12	17	35	2	NM		1007.5	13.4	13.4	9	10	17	9	14.5
PERNDALE	NORWEGIAN	3	41.6 N	48.2 W	00	27	40	5	NM	01	998.0	8.8	8.0	7	18			
SYLVO	NORWEGIAN	3	40.2 N	41.1 W	12	25	36	2	NM		1005.0	15.0	17.5					
SEALAND MARKET	AMERICAN	3	40.8 N	34.7 W	06	12	40	10	NM	02	1002.5	15.6	16.8	3	10			
SEALAND MC LEAN	AMERICAN	3	42.7 N	31.0 W	12	34	35	5	NM	07	1008.1	8.7	11.6	4	8.5	34	12	13
ZIM HONGKONG	LIBERIAN	3	41.6 N	44.7 W	12	29	45	5	NM	02	998.7	13.0	16.0	9	11.5			
SAN JUAN	AMERICAN	3	38.7 N	54.6 W	00	33	35	10	NM	02	1011.9	9.0	17.8	6	13	33	12	16.5
AMER ACE	AMERICAN	3	47.2 N	29.0 W	00	16	35	5	NM	07	1018.8	12.0	10.4	4	8			
AMER LEGEND	AMERICAN	3	43.2 N	44.0 W	18	29	36	5	NM	02	999.0	9.5	16.0	7	13			
CHEVRON BURNABY	LIBERIAN	4	40.2 N	61.9 W	12	11	M 45	5	NM	02	1008.5	13.7	14.0	4	11.5	09	8	18
PRINCE OF FUNDY	SWEDISH	4	43.7 N	57.5 W	18	02	48	1	NM		1004.9	7.0	4.0	8	19.5			
DEFIANCE	AMERICAN	6	38.8 N	58.7 W	18	19	35	5	NM	01	1005.3	19.4	17.2	3	5	21	7	10
CHARON	LIBERIAN	6	37.1 N	61.5 W	18	34	M 40	5	NM	29	1002.9	19.2	19.0	6	10	34	12	16.5
SHERMAN	AMERICAN	6	42.1 N	48.7 W	12	31	M 35	200	FG		998.6	9.0	8.3	4	13	31	6	8
AMER LEADER	AMERICAN	6	40.2 N	55.7 W	12	16	38	10	NM	02	1004.3	16.7	16.7	6	10	18	8	13.5
CAVALA	LIBERIAN	6	38.8 N	68.9 W	12	36	40	10	NM	18	1006.0	11.5	16.7	4	8	36	8	13.5
AMER LEADER	AMERICAN	7	40.7 N	51.7 W	00	15	35	10	NM	02	1016.8	17.0	17.2	6	11.5	16	7	24.5
ECLIPSE	AMERICAN	7	32.6 N	73.8 W	06	22	38	> 29	NM	00	1013.9	23.0	27.0	3	5			
SEALAND RESOURCE	AMERICAN	17	41.8 N	54.0 W	18	32	35	10	NM	01	1007.0	11.0	13.0	8	10			
CARBO SIERRA	NORWEGIAN	17	41.6 N	49.2 W	06	18	35	2	NM	83	1003.0	12.0	10.2	4	8			
ATLANTIC FOREST	NORWEGIAN	18	40.8 N	39.5 W	19	30	M 42	5	NM	80	1003.0	14.0			11.5			
AMER ACE	AMERICAN	18	41.8 N	50.3 W	12	27	38	10	NM	01	1011.0	8.5	8.5	6	13			
SEALAND CONSUMER	AMERICAN	18	43.7 N	29.5 W	18	18	35	5	NM	05	1031.0	18.7	14.5	4	5	18	7	8
GREAT REPUBLIC	AMERICAN	18	39.1 N	46.6 W	18	31	45	5	NM	02	1011.2	12.2	17.3	8	24.5			
CARBO SIERRA	NORWEGIAN	18	43.3 N	44.4 W	18	27	40	2	NM	80	998.0	8.0	9.0			27	8	19.5
SEALAND CONSUMER	AMERICAN	19	46.0 N	20.8 W	12	16	40	5	NM	02	1014.9	14.0	13.3	3	8	16	6	11.5
ZIM TOKYO	GERMAN	19	39.1 N	43.7 W	00	29	37	5	NM	02	1010.5	12.2	18.3	7	10	32	9	6
GREAT REPUBLIC	AMERICAN	19	39.3 N	49.8 W	06	32	35	5	NM	02	1015.7	19.4	17.2	6	13	32	8	19.5
LASH ATLANTICO	AMERICAN	19	38.1 N	48.2 W	12	27	40	10	NM	01	1013.2	17.2	18.3	7	13	27	10	13
SEA LIFT	AMERICAN	19	40.1 N	40.7 W	06	28	40	5	NM	07	1004.0	15.7	17.8	XX	10	28	>13	21
DOCTOR LYKES	AMERICAN	19	39.9 N	40.0 W	00	30	35	10	NM	01	1006.0	11.9	16.7	6	6.5	27	10	16.5
CARBO SIERRA	NORWEGIAN	19	43.2 N	49.2 W	06	27	38	2	NM		1003.0	8.8	9.0			27	8	19.5
YOUNG AMERICA	AMERICAN	19	46.7 N	37.2 W	06	19	35	10	NM	02	977.0	10.6	12.5	7	8	20	8	19.5
ATLANTIC FOREST	NORWEGIAN	19	39.8 N	40.9 W	00	28	M 35	10	NM	01	1007.5	19.7			13	26	X	19.5
LASH ATLANTICO	AMERICAN	20	43.0 N	44.0 W	00	28	35	10	NM	01	1017.6	17.8	18.3	4	13			
YOUNG AMERICA	AMERICAN	20	44.2 N	41.0 W	00	28	38	5	NM	05	998.0	11.1	15.6	8	13	30	10	23
EXPORT LEADER	AMERICAN	21	39.3 N	38.3 W	12	22	35	2	NM	89	1010.0	18.7	17.8	3	11.5	26	8	6
AMER LEADER	AMERICAN	23	41.4 N	31.2 W	12	10	35	10	NM	02	1009.5	8.7	16.7	3	8.5			
EXPORT BUILDER	AMERICAN	29	38.7 N	24.5 W	12	33	35	10	NM	01	1019.0	17.0	18.5	4	6.5	33	< 6	16
SEALAND MARKET	AMERICAN	30	40.8 N	42.8 W	06	27	35	10	NM	02	1006.4	19.5	14.0	4	8	28	8	13
SEALAND MARKET	AMERICAN	31	48.0 N	17.5 W	18	05	40	5	NM	02	1019.0	10.0	13.3	5	6.5	05	9	16.5
SEALAND RESOURCE	AMERICAN	31	41.0 N	47.1 W	06	33	43	9	NM	01	1009.0	10.0	13.7	6	10	33	8	16.5
GREAT LAKES VESSELS																		
ASHLAND	AMERICAN	21	47.3 N	89.2 W	00	26	M 35	10	NM	19		4.0	3.0	1	1.5			
NORTH ATLANTIC		JUNE																
SEALAND MARKET	AMERICAN	5	30.0 N	22.2 W	18	13	40	5	NM	10	991.0	17.5	18.3	8	13	31	10	18
SAN FRANCISCO	AMERICAN	5	40.2 N	57.0 W	18	02	38	10	NM	02	995.3	13.6	16.5	3	8	30	< 6	13
SEALAND MARKET	AMERICAN	6	47.4 N	29.5 W	06	31	42	10	NM	01	998.5	14.3	12.8	7	8	31	10	18
AMER ACCORD	AMERICAN	6	46.4 N	30.9 W	06	29	38	5	NM	02	998.5	12.2	14.4	5	8			
EXPORT DIPLOMAT	AMERICAN	6	39.3 N	39.0 W	18	20	35	5	NM	02	999.4	20.0	17.7	8	6	23	8	10
DOCTOR LYKES	AMERICAN	6	34.3 N	51.1 W	12	30	36	> 29	NM	21	1009.5	22.2	20.6	6	16.5			
EXPORT FREEDOM	AMERICAN	6	40.0 N	66.9 W	18	24	60	2	NM	82	1000.0	17.0	19.5	4	6.5			
AMER ACCORD	AMERICAN	7	44.4 N	28.0 W	00	30	35	2	NM	83	992.9	11.1	15.0	4	8	30	< 6	11.5
SEALAND MARKET	AMERICAN	7	43.5 N	40.4 W	00	01	40	10	NM	01	999.0	12.2	14.0	3	10	01	7	19.5
PALSTRIA	DANISH	7	45.7 N	34.8 W	18	33	M 41	5	NM	65	1004.8	13.3		8	14.5			
EXPORT DIPLOMAT	AMERICAN	7	39.4 N	31.4 W	12	29	40	5	NM	02	1008.2	17.8	17.8	6	14.5	23	8	13
DOCTOR LYKES	AMERICAN	7	35.1 N	47.2 W	00	32	38	10	NM	05	1015.6	16.7	18.9	6	16.5			
SEALAND MARKET	AMERICAN	8	41.0 N	61.6 W	12	27	45	10	NM	02	998.0	22.0	17.3	6	6.5	22	10	13
EXPORT	AMERICAN	8	45.3 N	46.1 W	12	18	50	5	NM	01	1008.0	13.7	14.0	8	8	28	9	28
AMER ACCORD	AMERICAN	9	41.2 N	62.7 W	18	32	39	10	NM	02	1007.5	13.2	18.9	5	8			
JOHN TYLER	AMERICAN	9	42.4 N	17.8 W	00	27	38	10	NM	01	1024.0	14.5	18.3	XX	6.5	XX	X	11.5
AMER ACCORD	AMERICAN	10	41.0 N	64.8 W	00	33	38	10	NM	02	1013.9	10.0	18.9	5	8			
YELLOWSTONE	AMERICAN	11	16.4 N	74.0 W	00	06	35	10	NM	02	1013.8	28.9	26.7	5	8	08	9	18
L W RUNKHOUSER	LIBERIAN	12	41.2 N	10.4 W	06	36	M 40	2	NM	10	1020.0	16.0	16.0	10	13			
MOBIL GAS	AMERICAN	13	40.2 N	70.3 W	12	17	40	5	NM	01	1017.3	18.2	17.8	9	6.5	18	10	14.5
SEALAND CONSUMER	AMERICAN	16	48.2 N	21.2 W	12	30	M 38	5	NM	05	1019.6	12.7	13.3	3	8	30	6	13
SEALAND MARKET	AMERICAN	19	49.4 N	07.9 W	06	22	40	5	NM	02	1019.0	16.5	13.3	6	10	22	10	13
CARBIDE TEXAS CITY	AMERICAN	22	39.2 N	71.2 W	06	07	40	10	NM	80	1023.7	20.2	18.4			07	< 6	13
SEALAND VENTURE	AMERICAN	22	34.4 N	51.0 W	06	32	M 36	5	NM	92	1016.3	22.7	23.2	4	8	32	< 6	8
WILMINGTON GETTY	AMERICAN	29	33.0 N	74.9 W	19	33	45 (A)	2	NM		1009.8	28.4	28.9	5	8			
MAYAGUEZ	AMERICAN	29	32.3 N	73.3 W	12	19	40 (A)	5	NM	01	1007.8	23.8	24.4	8	10			
MOBIL VALIANT	LIBERIAN	29	13.7 N	41.1 W	18	06	35	5	NM	02	1010.0	26.7	26.7	10	10			
ERIC H HOLZER	AMERICAN	29	34.3 N	71.8 W	18	14	40 (A)	1	NM	62	1010.9	21.3	23.4	5	8			
DALLAS	AMERICAN	30	34.4 N	73.7 W	18	36	60 (A)	2	NM	62	1012.8	22.5	26.1	7	29.5	09	10	14.5
BORINQUEN	AMERICAN	30	36.4 N	72.5 W	00	10	50	.5	NM	65	1008.8	20.6	24.4		24.5			
SAN JUAN	AMERICAN	30	37.1 N	72.3 W	18	02	60 (A)	9	NM	02	1006.4	22.8	28.3	8	16.5	02	12	29.5
MAYAGUEZ	AMERICAN	30	29.8 N	71.8 W	00	24	35 (A)	2	NM	18	1012.9	23.0	28.0	4	8			
MOBIL VALIANT	LIBERIAN	30	12.7 N	40.1 W	00	06	35	9	NM	02	1010.0	25.0	25.6	10	10			
MOBIL GAS	AMERICAN	30	34.0 N	75.8 W	18	02	40 (A)	10	NM	02	1015.9	26.8	28.7	5	6.5	10	9	10
JOHN TYLER	AMERICAN	30	33.3 N	68.9 W	18	20	40 (A)	2	NM		1008.4	22.7	28.8	5	11.5	23	7	24.5
ECLIPSE	AMERICAN	30	37.4 N	73.4 W	18	01	40 (A)	9	NM	86	1013.3	20.0	21.1	6	8	05	>13	19.5
GREAT LAKES VESSELS																		
PHILLIP R CLARKE	AMERICAN	16	47.3 N	86.3 W	06	23	M 35	2	NM	81		2.0	4.0	8	10			
ARMCO	AMERICAN	16	47.0 N	85.6 W	06	23	M 36	9	NM	02		6.0	4.0	2	5			

\+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind
(A) Tropical storm Amy

NOTE: The observations are selected from those with winds ≥ 35 kt or waves ≥ 25 ft from May through August (≥ 45 kt or ≥ 30 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest wind speed was selected.

Table 6

Selected Gale and Wave Observations, North Pacific

May and June 1975

Vessel	Nationality	Date	Position of Ship: Lat. deg.	Position of Ship: Long. deg.	Time GMT	Wind: Dir. 10's	Wind: Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C: Air	Temperature °C: Sea	Sea Waves*: Period sec.	Sea Waves*: Height ft.	Swell Waves: Dir. 10's	Swell Waves: Period sec.*	Swell Waves: Height ft.
NORTH PACIFIC		MAY															
NORTH STAR III	AMERICAN	1	54.6 N	164.0 W	00	32	N 40	> 25 NM	02	1010.5	- 2.2	3.3	3	5			
MONTIRON	LIBERIAN	2	53.2 N	179.5 E	06	13	N 38	2 NM	10	998.0	0.0						
VAN ENTERPRISE	LIBERIAN	2	47.3 N	167.2 E	00	29	N 40	10 NM	01	1001.0	8.0	2.0	8	13			
POLAR ALASKA	LIBERIAN	3	53.4 N	179.2 E	18	29	N 38	10 NM	29	1012.0	1.0	2.0	8	10			
HAWAIIAN CITIZEN	AMERICAN	3	41.9 N	133.5 W	06	29	40	5 NM	29	1016.8	7.2	12.2	8	14.5			
GRAND GLOBE	LIBERIAN	3	46.6 N	126.5 W	00	18	N 38	200 YD		994.0	9.5	10.0			14	8	16.5
SYUKO MARU	JAPANESE	4	52.3 N	163.0 W	18	23	N 40	2 NM	07	1014.5	5.5	1.0	8	14.5	24	9	19.5
HAWAIIAN CITIZEN	AMERICAN	4	43.0 N	133.2 W	00	29	35	10 NM	02	1023.5	8.9	11.7					
HAWAIIAN LEGISLATOR	AMERICAN	4	23.7 N	152.7 W	12	09	35	10 NM	02	1024.4	20.0	23.3	4	11.5	09	10	16
CHALMETTE	LIBERIAN	4	54.0 N	160.1 W	12	26	40	10 NM	02	1005.5	3.8	2.8	14	19.5			
VAN ENTERPRISE	LIBERIAN	4	40.1 N	149.7 E	18	18	N 40	1 NM	61	1003.0	13.0	12.0					
BELMUDSON	BRITISH	4	35.1 N	143.7 E	00	19	N 39	5 NM	02	1012.0	18.8	20.0	4	8			
PACIFIC CARRIER	LIBERIAN	5	33.9 N	120.3 W	06	32	35	10 NM	08	1014.6	11.6	12.2					
RICHARD	LIBERIAN	5	28.7 N	117.3 W	12	33	40	10 NM	00	1018.0	12.5	18.0	9	9	32	< 6	13
SYUKO MARU	JAPANESE	5	51.8 N	171.0 W	18	22	N 37	1 NM	63	1000.9	5.0	1.0	8	14.5			
HAWAIIAN LEGISLATOR	AMERICAN	5	28.4 N	146.1 W	12	09	40	5 NM	18	1025.0	19.5	22.0	5	13	09	10	19.9
HARBOUR BRIDGE	SINGAPORE	5	50.1 N	170.1 W	18	24	N 36	2 NM	63	1009.2	3.2	5.0	5	19	24	9	18
CHALMETTE	LIBERIAN	6	53.0 N	172.9 E	18	04	N 38	.5 NM	63	981.1	6.8	8.0	5	11.5			
SYUKO MARU	JAPANESE	6	50.6 N	179.7 W	18	23	N 39	1 NM	50	979.0	5.5	1.0	8	14.5	23	9	18
RICHARD	LIBERIAN	6	33.5 N	120.9 W	12	33	35	5 NM	00	1016.0	12.5	16.0	9	5	33	< 6	13
HARBOUR BRIDGE	SINGAPORE	6	50.1 N	167.4 W	00	17	N 33	5 NM	01	1008.3	4.5	5.0	5	13	23	9	18
PLUTOS	GERMAN	7	42.5 N	162.9 W	18	30	35	5 NM	01	1008.8	9.2	9.0	8	16.5			
RICHARD	LIBERIAN	7	38.4 N	124.0 W	12	33	40	10 NM	02	1017.2	11.0	13.5			33	< 6	8
PHIL MAIL	AMERICAN	7	46.3 N	169.1 W	06	31	50	2 NM	10	998.0	5.6	5.0	9	8	30	>13	23
OREGON STANDARD	AMERICAN	7	35.1 N	120.9 W	00	34	36	10 NM	02	1015.0	10.0	10.0	9	6.5	31	< 6	11.5
PACIFIC GLORY	PANAMANIAN	7	51.2 N	177.3 W	00	34	N 35	10 NM	02	981.3	2.0		10	10	34	11	10
PLUVIUS	GERMAN	7	43.7 N	171.4 W	06	29	40	5 NM	20	1009.0	11.3	9.5	5	16.5	26	7	21
J H TUTTLE	AMERICAN	7	49.5 N	144.0 W	18	16	50	2 NM	68	994.2	4.4	5.6	2	5	27	< 6	6.5
MONTIGNY	LIBERIAN	7	49.3 N	167.9 W	12	33	N 50	1 NM	50	992.2	3.3	7.0	9	19.5			
HARBOUR BRIDGE	SINGAPORE	7	50.6 N	148.7 W	18	17	N 39	2 NM	63	978.2	4.8	5.5	9	11.5	18	10	19.5
CHINA BEAR	AMERICAN	7	44.0 N	161.5 W	12	27	40	2 NM	63		9.6	8.7	7	18			
CHEVRON HAWAII	AMERICAN	7	34.6 N	144.5 W	18	14	40	5 NM	63	998.0	4.4	2.2	6	11.5	27	7	10
CHALMETTE	LIBERIAN	7	52.8 N	178.4 E	00	01	35	10 NM	02	1002.0	1.8	4.0	7	11.5			
BRIGHT HOPE	CHINESE	7	49.5 N	164.7 W	18	36	N 40	5 NM	00	1000.0	5.0	4.0	6	13			
AMER LYNX	AMERICAN	7	41.8 N	169.3 W	18	32	37	5 NM	02	1015.2	7.2	8.3	10	19.5			
SEALAND EXCHANGE	AMERICAN	7	52.4 N	161.3 W	12	05	35	5 NM	02	978.7	2.3	2.7					
J H TUTTLE	AMERICAN	8	49.8 N	145.0 W	00	14	50	2 NM	63	981.8	6.9	5.6			16	6	10
HARBOUR BRIDGE	SINGAPORE	8	50.5 N	141.4 W	12	17	N 35	2 NM	63	981.5	7.0	6.5	5	11.5	15	10	19.5
CHINA BEAR	AMERICAN	8	44.0 N	158.1 W	00	29	35	2 NM	10	990.4	7.8	8.2	8	24.5			
CHEVRON HAWAII	AMERICAN	8	32.3 N	140.9 W	06	14	40	2 NM	63	991.4	5.0	2.8	4	10	14	6	14.5
CHALMETTE	LIBERIAN	8	50.6 N	168.8 E	06	20	N 62	5 NM	20	990.0	3.0	3.8	6	10	20	9	13
MONTIGNY	LIBERIAN	8	48.7 N	162.3 W	06	32	N 40	10 NM	16	1009.7	4.2	8.0	7	13	33	11	18
PORTLAND	AMERICAN	8	36.2 N	142.6 W	12	10	40	5 NM	58	1003.1	4.4	5.0	4	8	10	6	14.5
PHILADELPHIA	AMERICAN	8	52.5 N	134.0 W	12	14	40	5 NM	81	1005.8	6.3	8.3			14	8	11.5
PLUTOS	GERMAN	8	42.5 N	154.2 W	18	31	37	10 NM	15	1000.2	9.8	9.1	7	10	32	10	16.5
PHIL MAIL	AMERICAN	8	47.6 N	156.4 W	18	31	35	5 NM	31	1002.0	3.9	5.6	6	6.5	31	11	19.5
VAN PORT	LIBERIAN	8	50.0 N	137.9 W	18	12	N 35	5 NM	50	989.0	8.5	7.0					
YANGMING	CHINESE	8	38.5 N	153.8 W	00	27	N 39	2 NM	20	1011.0	15.5	15.0	7	11.5			
AMER LYNX	AMERICAN	8	40.7 N	160.4 W	06	32	40	5 NM	02	1016.8	8.3	8.8	12	23			
BRIGHT HOPE	CHINESE	8	47.9 N	157.3 W	18	33	N 40	5 NM	00	1003.0	6.0	4.0	6	16.5	33	6	19.5
CHALMETTE	LIBERIAN	9	50.2 N	166.3 E	00	31	40	10 NM	02	1005.4	4.2	3.2	8	13			
CHINA BEAR	AMERICAN	9	42.9 N	145.8 W	00	30	40	5 NM	18	991.9	10.0	8.9	7	21	31	8	24.5
MONTIGNY	LIBERIAN	9	49.2 N	153.9 W	06	34	N 40	5 NM	09	1001.2	4.2	8.0	7	13	34	10	19.5
HARBOUR BRIDGE	SINGAPORE	9	50.8 N	136.9 W	00	19	N 40	1 NM	61	990.0	8.3	7.0	8	11.5	14	10	19.5
BRIGHT HOPE	CHINESE	9	46.8 N	153.6 W	06	33	N 40	5 NM	02	1000.0	8.0	4.0	6	16.5	33	6	19.5
AMER LYNX	AMERICAN	9	38.7 N	153.3 W	00	32	37	5 NM	02	1014.6	11.2	12.2	12	23			
TREIN MAERSK	DANISH	9	35.5 N	136.6 W	00	23	36	10 NM	02	1009.0	18.0	16.0	6	13			
LIONS GATE BRIDGE	JAPANESE	9	49.4 N	153.7 W	06	32	N 35	5 NM	02	1000.0	5.0	5.5	7	10	33	11	19.5
J H TUTTLE	AMERICAN	9	52.2 N	153.2 E	06	36	50	.5 NM	09	998.0	5.0	3.9	4	8			
PACIFIC GLORY	PANAMANIAN	9	49.0 N	169.6 E	00	29	N 40	> 25 NM	01	1001.2	8.0		6	11.5			
PLUVIUS	GERMAN	9	41.7 N	170.3 E	06	28	37	5 NM	25	1019.7	6.8	10.0	6	14.5			
PORTLAND	AMERICAN	9	53.3 N	139.7 W	00	10	40	2 NM	10	1002.0	8.9	5.6	4	6.5	10	7	14.5
PLUTOS	GERMAN	9	42.4 N	150.1 W	06	30	37	2 NM	50	1002.3	8.0	8.8	8	10	31	11	19.5
PHIL MAIL	AMERICAN	9	45.9 N	151.7 W	06	30	40	5 NM		997.0	6.4	8.7	7	8	30	10	23
SEALAND TRADE	AMERICAN	10	35.2 N	151.2 E	12	20	35	5 NM	05	997.6	17.8	18.3	7	10			
BAY BRIDGE	SINGAPORE	11	44.8 N	146.5 W	00	27	N 43	10 NM	02	1008.2	11.0	10.0	8	13			
SEALAND TRADE	AMERICAN	11	39.1 N	149.7 E	00	01	40	10 NM	01	1007.1	14.0	16.7	5	10			
ASIA BEAUTY	LIBERIAN	12	53.3 N	179.9 W	18	14	N 41	1 NM	60	992.9	7.0	9.0	4	8			
BAY BRIDGE	SINGAPORE	12	47.4 N	153.6 W	00	23	N 39	10 NM	02	1000.6	8.0	7.5	4	8	23	10	13
BERKSHIRE	BRITISH	12	34.7 N	149.2 E	00	18	37	5 NM	50	1012.1	20.2	16.7	4	6.5	18	< 6	11.5
INDIAN MAIL	AMERICAN	12	51.1 N	169.8 E	00	11	40	2 NM	10	988.5	9.0	9.9	XX	8	11	8	19.5
SUMMIT	AMERICAN	12	52.8 N	171.9 W	00	32	39	10 NM	02	1012.5	9.9	9.4	9	8	32	6	11.5
ASIA BEAUTY	LIBERIAN	13	52.8 N	178.3 E	06	24	N 45	5 NM	23	990.6	8.0	8.0	5	10			
SHUNWIND	LIBERIAN	13	46.5 N	170.0 E	06	25	N 39	10 NM	03	1002.5	9.0	8.0	9	11.5			
NORTH STAR III	AMERICAN	13	53.0 N	168.9 W	06	11	N 37	2 NM	23	999.8	1.1	3.6	9	5			
INDIAN MAIL	AMERICAN	13	49.9 N	166.9 E	00	23	35	2 NM		988.4	9.9	8.8	8	8	26	10	26
SEALAND TRADE	AMERICAN	14	32.9 N	133.2 E	12	34	35	10 NM	02	1007.1	18.9	18.9	8	6.5			
WASHINGTON	AMERICAN	15	42.7 N	179.9 E	00	27	40	10 NM	02	1009.5	13.5	10.0	9	10	29	11	23
PRES HARRISON	AMERICAN	15	37.0 N	156.3 E	18	08	40	5 NM	65	1010.0	16.7	12.8	2	8			
THOMAS E CUFFE	AMERICAN	16	34.6 N	156.6 E	00	08	N 43	5 NM	10	1010.0	15.0	18.3	9	11.5			
PRES HARRISON	AMERICAN	16	37.5 N	160.9 E	06	08	35	10 NM	02	1014.6	14.4	14.4	3	6.5	08	6	16
ORIENTAL DESTINY	LIBERIAN	17	35.6 N	150.2 E	18	14	40	1 NM	63	998.6	19.0	21.2					
VAN PORT	LIBERIAN	18	41.3 N	150.5 E	00	10	N 45	.5 NM	63	998.0	10.0	11.0					
NEDNIA	DANISH	18	39.8 N	124.3 W	06	33	N 44	> 25 NM	00	1012.0	13.2				32	6	13
PLUVIUS	GERMAN	18	35.3 N	158.2 E	06	17	42	2 NM	60	1005.1	18.9	17.2	5	16.5	11	8	23
ANAX TRADER	LIBERIAN	19	42.6 N	132.2 E	06	08	46	5 NM	02	1012.9	8.5	8.0	5	10	XX	X	11.5
HAWAIIAN MONARCH	AMERICAN	19	32.8 N	125.1 W	00	36	36	10 NM	02	1018.3	15.0	13.9	5	8			
PACIFIC PHOENIX	LIBERIAN	19	49.0 N	153.9 W	12	14	40	.5 NM	59	1009.0	5.5		4	13	14	< 6	19.5
CHALMETTE	LIBERIAN	20	33.7 N	137.4 E	12	33	40	> 25 NM	02	1004.3	16.0	17.0	4	5			

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind			Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves		Swell Waves	
			Lat. deg.	Long. deg.		Dir. app.	Speed kt.					Air	Sea	Period sec.	Height ft.	Dir. app.	Period sec.*	Height ft.
NORTH PACIFIC OCEAN		MAY																
EASTERN BUILDER	LIBERIAN	20	42.2 N	151.2 E	18	18	N 47		1 NM	04	977.3	10.0	8.0	9	13			
CRESSIDA	PANAMANIAN	20	42.7 N	152.0 E	18	19	N 36		2 NM	80	981.0	11.0	9.0	6	13			
PLUVIUS	GERMAN	20	35.8 N	179.2 E	06	10	38		10 NM	25	1007.6	14.5	16.0	4	10	11	7	19.5
J H TUTTLE	AMERICAN	20	39.0 N	124.6 W	06	34	35	>	25 NM	01	1017.5	9.4	10.0	3	8	34	>13	14.5
MOBILE	AMERICAN	20	56.9 N	142.2 W	12	13	40		5 NM	02	1005.8	8.0	9.0	5	16.5			
MONTIGNY	LIBERIAN	20	30.5 N	139.6 W	12	18	N 36		5 NM	05	1017.7	8.4	10.0	5	10			
UNION FRIENDSHIP	LIBERIAN	20	38.0 N	145.5 E	18	27	N 35		5 NM	02	995.0	12.5	10.0	6	13	33	9	19.5
SANSINENA II	AMERICAN	20	47.7 N	132.2 W	00	34	35		10 NM	01	1031.0	9.2	7.7	4	6.5	32	8	10
SEALAND TRADE	AMERICAN	20	31.7 N	132.1 E	12	36	38		10 NM	01	1009.5	17.8	20.5	6	10			
VAN ENTERPRISE	LIBERIAN	20	40.0 N	149.0 E	18	24	N 40		2 NM	69	983.0	10.0	14.0	10	8	24	10	13
AMAX TRADER	LIBERIAN	20	37.9 N	144.1 E	18	27	40		5 NM	02	995.9	12.0	12.0	4	10			
ARCO PRUDHOE BAY	AMERICAN	20	33.7 N	119.5 W	18	27	36		5 NM	05	1005.8	15.0	14.4	5	16.5			
CRESSIDA	PANAMANIAN	21	41.6 N	149.9 E	06	26	N 30		1 NM	63	987.0	9.0	9.8	7	14.5			
EASTERN BUILDER	LIBERIAN	21	41.7 N	150.4 E	06	29	N 30		1 NM	99	988.0	9.0	9.0	8	13	27	13	24.5
GRAND GLOBE	LIBERIAN	21	42.9 N	149.9 E	06	31	N 40		.25 NM	45	981.5	4.2	4.0			31	13	19.5
PLUVIUS	GERMAN	21	38.7 N	170.0 W	18	36	48		10 NM	25	1012.1	13.4	15.1	4	19.5	01	6	29.5
M M DANT	AMERICAN	21	37.3 N	124.5 W	00	34	45		5 NM	03	1017.9	13.3	10.0	6	16.5	34	9	23
J H TUTTLE	AMERICAN	21	39.9 N	125.8 W	00	34	45		10 NM	03	1021.3	13.0	11.1	3	8	34	8	11.5
TRANSOCEAN TRANSPORT	PHILIPPINE	21	47.0 N	162.5 E	06	14	N 40		.5 NM		1006.0	8.0	4.4	8	14.5			
UNION FRIENDSHIP	LIBERIAN	21	38.3 N	149.0 E	06	28	N 38		5 NM	02	1001.0	14.5	9.0	6	13	33	9	19.5
VAN ENTERPRISE	LIBERIAN	21	41.6 N	152.9 E	06	24	N 30		2 NM	40	985.0	8.0	8.0			24	10	16.5
WYOMING	AMERICAN	21	37.2 N	127.7 W	06	34	35		10 NM	01	1023.2	10.6	10.6	3	6.5	34	8	10
VAN CONQUEROR	LIBERIAN	21	43.2 N	157.0 E	18	23	N 35		5 NM	10	993.0	8.0	8.0					
ASIA BRIGHTNESS	LIBERIAN	21	44.6 N	149.6 E	18	27	40		5 NM	51	992.0	2.0	5.0	5	10	18	6	11.5
VAN ENTERPRISE	LIBERIAN	22	44.2 N	159.3 E	06	22	N 38		2 NM		996.0	10.0	8.0	9	10	22	11	16.5
UNION FRIENDSHIP	LIBERIAN	22	38.9 N	154.6 E	00	28	N 35	>	25 NM	00	1009.5	17.0	15.0	4	6.5	26	8	6.5
VAN CONQUEROR	LIBERIAN	22	42.9 N	156.1 E	00	24	N 48		3 NM	51	996.0	8.0	8.0					
PLUVIUS	GERMAN	22	33.7 N	166.5 W	06	07	44		10 NM	16	1009.5	14.1	13.3	6	19.5	36	9	26
J H TUTTLE	AMERICAN	22	48.0 N	126.2 W	18	07	40		10 NM	02	1018.2	10.0	9.4	3	6.5			
MAMMOTH PINE	LIBERIAN	22	46.1 N	162.5 E	12	19	N 40		.5 NM	05	995.0	5.0	4.0	8	8	22	11	13
TRANSOCEAN TRANSPORT	PHILIPPINE	23	41.9 N	155.8 E	06	28	N 36		2 NM	20	1015.0	7.0	10.0	8	16.5	28	8	29.5
PLUVIUS	GERMAN	23	36.1 N	152.8 W	18	13	37		5 NM	62	1013.5	19.2	18.1	4	16.5	16	7	23
MAMMOTH PINE	LIBERIAN	23	44.9 N	159.3 E	12	31	N 40		5 NM	02	1002.0	6.0	8.0	8	10	27	12	16.5
NORBROTT	NORWEGIAN	23	38.8 N	164.5 W	12	31	35		5 NM	02	1013.5	11.0	17.0	3	10			
UNION FRIENDSHIP	LIBERIAN	24	43.2 N	175.8 E	18	25	N 33		5 NM	02	1012.0	9.0	9.0	4	8	25	X	8
STOLT DRAGON	LIBERIAN	24	39.7 N	163.7 W	00	27	35		10 NM	02	1015.0	13.0	14.0	6	13			
PLUVIUS	GERMAN	24	36.2 N	150.6 W	00	17	35		5 NM	02	1016.2	19.4	18.2	3	11.5	18	6	16.5
J H TUTTLE	AMERICAN	24	51.4 N	150.3 E	12	12	45		2 NM	50	1003.0	6.1	6.6	5	8	12	10	13
SURVEYOR	AMERICAN	25	57.3 N	155.3 W	00	03	N 45		5 NM	79	1006.1	4.1	4.4		8			
UNION FRIENDSHIP	LIBERIAN	25	43.6 N	179.9 E	06	27	N 35		2 NM	58	1005.0	10.5	8.0	4	8	27	X	8
SANSINENA II	AMERICAN	25	35.2 N	143.2 W	06	11	35		5 NM	02	1012.5	9.5	9.4	8	11.5			
CHEVRON HAWAII	AMERICAN	25	58.2 N	149.9 W	18	13	35		5 NM	63	1002.1	5.0	5.3	4	13	10	8	19.5
GALVESTON	AMERICAN	25	55.0 N	140.7 W	12	12	40		5 NM	61	1011.3	5.0	5.5	4	10	12	8	13
CHALMETTE	LIBERIAN	25	40.1 N	175.2 E	12	27	N 34		2 NM	25	1015.1	9.0	12.0	7	8	27	11	10
PACSTAR	LIBERIAN	25	50.2 N	142.8 W	00	14	35		1 NM	10	1008.0	9.0	8.0	10	13			
PLUTOS	GERMAN	25	36.1 N	151.3 E	12	12	35		2 NM	62	1016.8	14.8	16.0	5	6.5	14	6	13
NEONIA	DANISH	25	41.6 N	124.8 W	00	34	N 40		10 NM	02	1020.5	12.6		3	13			
CHALMETTE	LIBERIAN	26	40.7 N	179.3 E	00	30	N 38		10 NM	16	1013.1	9.5	12.8	8	10			
CHEVRON HAWAII	AMERICAN	26	57.4 N	148.7 W	00	12	40		10 NM	01	1001.8	6.8	5.3	3	10	14	7	16
NORTH STAR III	AMERICAN	26	58.9 N	160.4 W	12	11	N 45		10 NM	21	997.3	5.9	5.0	5	5			
STOLT DRAGON	LIBERIAN	26	38.7 N	178.1 W	12	27	40		10 NM	03	1016.0	12.0	13.0	8	23			
ATLANTIDE	SWEDISH	26	39.5 N	148.0 E	06	05	34		1 NM	10	1000.0	13.0	14.0	12	8	05	>13	11.5
CHEVRON HAWAII	AMERICAN	27	50.6 N	138.5 W	12	12	35		5 NM	51	1009.8	8.3	4.4	3	8	17	6	11.5
NORTH STAR III	AMERICAN	27	58.9 N	160.4 W	06	11	N 35		5 NM	60	998.2	4.4	4.4	5	6.5			
PORTLAND	AMERICAN	28	54.4 N	138.4 W	00	13	35		2 NM	29	1010.5	7.3	7.2	4	6.5	13	8	8
THOMAS E CUFFE	AMERICAN	30	35.9 N	127.2 W	00	34	N 38		10 NM	02	1015.9	13.9	13.6	4	6.5			
NORTH PACIFIC		JUNE																
INGER	AMERICAN	3	17.0 N	100.9 W	21	10	40 (A)		5 NM	60	1001.5	25.3	28.8	XX	6.5	11	6	11.5
SEALAND TRADE	AMERICAN	3	38.2 N	123.8 W	06	23	38		10 NM	02	1014.6	11.2	12.3	6	10			
ROBERTS BANK	LIBERIAN	4	52.4 N	130.8 W	00	23	40		5 NM	03	990.4	8.5	9.0	6	10	23	6	16.5
NEWARK	AMERICAN	4	53.2 N	135.7 W	00	25	35		5 NM	50	1002.4	8.3	9.4	6	10			
WASHINGTON	AMERICAN	4	37.5 N	125.4 W	00	34	35		10 NM	02	1012.5	13.0	11.7	5	6.5	32	13	10
OCEANOGRAPHER	AMERICAN	4	39.4 N	124.9 W	12	33	N 37		10 NM	02	1011.3	12.1	10.2	5	11.5			
AMER LEGION	AMERICAN	4	17.0 N	101.5 W	06	14	45 (A)		10 NM	82	1009.4	23.8	25.0	3	13	14	6	26
INGER	AMERICAN	4	16.8 N	100.6 W	00	07	35 (A)		5 NM	82	1002.2	26.6	28.8	XX	8	21	6	11.5
GRETE MAERSK	DANISH	4	17.8 N	105.4 W	22	32	47 (A)		10 NM	65	1000.0	21.5	20.0	7	14.8			
WORLD PRIDE	LIBERIAN	5	33.3 N	137.5 E	00	14	35		.5 NM	65	1005.0	21.0	20.0	5	11.5	14	6	14.5
PHIL PRES MAGSAYSAY	PHILIPPINE	5	34.1 N	168.1 W	18	12	36		5 NM	80	1020.8	17.0	21.0	5	6.5			
ATLANTIDE	SWEDISH	6	40.8 N	154.1 E	12	18	35		5 NM	65	1003.0	17.0	15.0	6	8	18	10	8
LONG BEACH	PANAMANIAN	6	35.0 N	173.8 W	00	16	35		5 NM	03	1011.0	19.0	18.0	5	13	20	< 6	8
TRANSCOLORADO	AMERICAN	7	47.0 N	149.4 W	18	18	35		2 NM	41	1003.7	8.3	8.3	8	16.5			
SEALAND COMMERCE	AMERICAN	7	35.1 N	149.9 E	18	26	35		2 NM		1003.0	21.7	19.5	5	8			
ZIM TOKYO	GERMAN	7	40.0 N	162.2 W	06	28	48		5 NM	02	1011.5	11.2	13.0	6	11.5			
JAPAN CADET	LIBERIAN	7	44.7 N	150.5 W	12	17	40		1 NM	99	1008.0	13.0	8.0					
PRES HARRISON	AMERICAN	7	35.6 N	146.4 E	06	23	35		2 NM		999.5	21.1	18.3	5	8	23	8	16.5
PIONEER COMMANDER	AMERICAN	7	31.5 N	132.8 W	00	04	35		10 NM	02	1022.2	21.6	17.8	4	10	04	< 6	13
HAWAIIAN PROGRESS	AMERICAN	7	36.8 N	128.8 W	18	34	40		10 NM	01	1020.0	14.4	13.0	6	10			
ASIA BRIGHTNESS	LIBERIAN	7	45.4 N	162.7 E	18	12	35		.5 NM	44	1000.0	9.0	6.0	5	10			
SUMMIT	AMERICAN	8	56.1 N	157.4 W	18	08	40		5 NM	51	1001.5	5.0	5.5	3	5	08	< 6	14.5
SYUKO MARU	JAPANESE	8	49.0 N	141.7 W	00	13	N 37		1 NM	51	1019.5	9.5	6.0	6	8	13	7	21
NEWARK	AMERICAN	8	56.1 N	147.0 W	12	11	40		5 NM	51	1009.1	5.0	5.6	3	13			
ASIA BRIGHTNESS	LIBERIAN	8	48.4 N	168.5 E	18	11	35		.5 NM	44	989.0	8.0	6.0	5	11.5			
EXXON BOSTON	AMERICAN	8	39.1 N	124.3 W	12	33	40		10 NM	02	1014.9	11.6	14.4	11	14.8			
BAY BRIDGE	SINGAPORE	8	49.7 N	140.9 W	00	16	N 39		1 NM		1020.2	9.0	8.0	6	10			
J H TUTTLE	AMERICAN	8	51.5 N	151.0 W	06	28	50		1 NM	20	998.7	4.4	5.0	2	8	22	10	14.5
ATLANTIDE	SWEDISH	8	43.3 N	175.3 E	18	10	40		1 NM	65	1001.0	11.0	8.0	8	10.5			
PRESIDENT MADISON	AMERICAN	9	36.0 N	179.4 E	00	20	35		5 NM	20	1005.4	18.3	15.0	5	8	20	8	11.5
KRONOLAND	SWEDISH	9	35.8 N	179.5 W	06	17	40		5 NM	63	1013.0	17.0						
J H TUTTLE	AMERICAN	9	53.0 N	157.0 W	00	31	45		10 NM	01	1000.0	6.1	4.4	5	13			
GRAND GLOBE	LIBERIAN	9	43.1 N	170.5 E	06	27	N 40		1 NM	03	998.0	7.8	9.0			29	12	14.5
ASIA BRIGHTNESS	LIBERIAN	9	46.6 N	170.3 E	00	08	35		.5 NM	44	985.0	9.0	6.0	6	11.5			
ZIM TOKYO	GERMAN	9	40.2 N	178.0 E	00	17	40		1 NM	61	1003.0	13.8	13.9	7	11.5			
SUMMIT	AMERICAN	9	54.2 N	164.5 W	12	23	35		10 NM	02	1007.8	4.4	4.4	4	6.5			
ATLANTIDE	SWEDISH	9	43.0 N	178.0 W	12	10	40		2 NM	64	997.0	11.0	8.0	8	16.5			
PRES TAFT	AMERICAN	10	42.8 N	159.1 W	12	15	40		5 NM	03	1004.0	10.6	8.3	6				
JAPAN MAIL	AMERICAN	10	42.9 N	174.2 E	00	28	40		2 NM	12	1000.0	8.4	8.4	6	6.5	29	9	21
SEALAND MC LEAN	AMERICAN	10	37.8 N	165.5 W	06	18	35		1 NM	21	1011.5	17.2	14.0	4	10			

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb	Temperature °C		Sea Waves*			Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.*	Height ft.	
NORTH PACIFIC OCEAN		JUNE																
UNION FRIENDSHIP	LIBERIAN	10	52.3 N	149.3 W	06	24	M 35	5 NM	04	1022.0	6.3	4.0	9	13	23	9	13	
SEALAND EXCHANGE	AMERICAN	10	48.9 N	174.1 W	06	07	40	2 NM	03	991.3	8.1	4.6	7	8	XX	X	14.5	
JAPAN BEAR	AMERICAN	11	41.3 N	127.6 W	12	01	M 38	10 NM	01	1018.5	7.8	11.7	7	10	13	6	10	
GRAND GLOBE	LIBERIAN	11	43.8 N	172.0 W	06	27	M 38	.5 NM	05	992.0	8.0	8.4	5	6.5	28	>13	19.5	
JAPAN MAIL	AMERICAN	11	43.5 N	177.5 W	00	31	40	10 NM	03	1002.0	7.2	7.8	5	6.5	32	8	21	
PRES TAFT	AMERICAN	11	42.3 N	149.4 W	12	19	35	10 NM	60	1013.6	12.8	10.6						
SEALAND EXCHANGE	AMERICAN	11	50.5 N	169.3 W	00	08	40	1 NM	07	998.5	8.0	4.4	4	6.5	08	7	13	
YAN CONQUEROR	LIBERIAN	11	50.1 N	153.6 W	06	09	M 38	2 NM	92	1000.0	7.0	6.0						
J H TUTTLE	AMERICAN	12	39.1 N	157.3 W	06	05	40	10 NM	02	996.5	5.0	5.0	3	8	09	10	11.5	
PORTLAND	AMERICAN	12	58.5 N	149.2 W	00	07	35	5 NM	50	1017.6	8.3	7.7	4	6.5				
SUMMIT	AMERICAN	12	52.8 N	171.0 W	06	03	35	10 NM	03	1006.2	3.5	3.0	3	8				
UNION FRIENDSHIP	LIBERIAN	13	49.1 N	161.3 E	18	24	M 38	1 NM	40	1023.0	4.0	4.0	6	10	24	9	13	
HARBOUR BRIDGE	SINGAPORE	15	49.8 N	172.2 W	06	08	M 40	2 NM	65	999.4	6.0	6.0	6	13	09	8	16.5	
PHILADELPHIA	AMERICAN	15	52.0 N	134.8 W	00	28	37	5 NM	02	1019.0	10.0	7.2	4	10	24	10	16	
UNION FRIENDSHIP	LIBERIAN	16	47.6 N	156.2 E	12	24	M 38	2 NM	40	1020.0	6.3	5.0	6	10	24	9	13	
SANSINENA II	AMERICAN	17	41.8 N	127.3 W	00	34	38	10 NM	02	1022.0	14.0	11.1	5	5	35	7	6	
SGT ANDREW MILLER	AMERICAN	17	11.4 N	160.7 E	12	07	40	10 NM	03	1011.8	27.7	28.3	5	6.5				
NORBROTT	NORWEGIAN	17	38.5 N	166.7 E	18	18	35	2 NM	43	1013.0	15.0	14.0	6	10	13	6	10	
NORBROTT	NORWEGIAN	18	38.5 N	170.2 E	06	20	35	2 NM	43	1016.0	15.0	14.5	6	10				
HAWAII	AMERICAN	19	34.4 N	152.9 E	18	29	35	10 NM	02	1008.5	19.4	22.8	6	13	24	< 6	8	
PACIFIC BEAR	AMERICAN	22	37.5 N	124.8 W	06	31	40	10 NM	02	1017.3	11.2	11.6			31	7	16.5	
PHIL MAIL	AMERICAN	23	38.7 N	148.0 E	00	12	38	1 NM	63	1000.0	18.9	18.0	5	16				
SANSINENA II	AMERICAN	24	51.9 N	137.4 W	00	20	39	10 NM	02	1013.2	8.9	6.7	4	8	23	9	8	
SEALAND EXCHANGE	AMERICAN	28	35.7 N	148.6 E	18	26	35	10 NM	21	998.0	20.0	19.4	3	5	22	< 6	19.5	
J H TUTTLE	AMERICAN	28	56.8 N	167.1 W	18	11	39	.5 NM	49	987.3	4.4	2.8	8	10				
SUMMIT	AMERICAN	29	53.8 N	148.2 W	06	22	40	2 NM	51	988.0	5.3	3.5	4	8	22	< 6	11.5	
AMER LEGION	AMERICAN	29	37.2 N	124.1 W	06	28	36	10 NM	00	1017.3	12.8	10.0	0	6.5	24	6	8	
J H TUTTLE	AMERICAN	29	53.6 N	166.6 W	00	19	40	10 NM	02	999.0	6.7	2.8	6	10				

* Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind
(A) Hurricane Agatha

NOTE: The observations are selected from those with winds ≥ 35 kt or waves ≥ 25 ft from May through August (≥ 41 kt or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest wind speed was selected.

Rough Log, North Atlantic Weather

August and September 1975

ROUGH LOG, AUGUST 1975--The paths traced by the centers of the cyclones this month were near normal. The main area of activity was over Canada. Some of this activity moved northeastward toward and into Baffin Bay, while some moved eastward across the Labrador Sea toward Iceland and the Norwegian Sea. Several storms moved eastward across the U.S. Atlantic coast, where there was a flurry of activity south of Newfoundland. These storms then moved northeastward.

The monthly mean sea-level pressure pattern was nearly a carbon copy of climatology, except over the North Pole. The Azores High, at 1023 mb, extended slightly farther to the northeast than usual, into the Bay of Biscay. The Icelandic Low, at 1006 mb, was near 60°N, 30°W. There was also an area of weak low gradient over northern Quebec and Baffin Island. A 1002-mb LOW was centered near the North Pole.

The largest anomaly was 4 mb, of which there were several. A negative 4-mb was centered near 60°N, 30°W, with the LOW. A trough south of Newfoundland produced another negative 4-mb near 40°N, 50°W. The 4-mb isoline extended about 500 mi southwestward from the English Channel, then curved back over the Faeroe Islands to enclose a larger anomaly over Scandinavia.

The 700-mb surface was near normal. The troughing normally over the U.S. east coast was slightly sharper, and off the coast rather than over it. The primary gradient and wind band spanned 40° to 60°N over the ocean. The major anomalies were a negative center south of Newfoundland and a positive center over Scandinavia.

Hurricanes Caroline and Doris developed late in the month.

Extratropical Cyclones--There were several LOWs over the Grand Banks, early on the 1st. Later in the day, the reports indicated they had combined into one center, near 40°N, 55°W. At 0000 on the 2d, the BENEFACTOR, to the west of the center, reported lightning and 20-ft swells. The pressure gradient around the center was weak, and the only front was miles to the north. The center drifted southward and westward until, on the 3d, it reversed itself and drifted northeastward.

The first gale-force wind was observed by the IMPERIAL QUEBEC off Halifax on the 5th. On the 6th, the LOW became associated with the upper-air zonal flow and started moving eastward. At 1200 on the 7th, the AMERICAN RANGER was near 41°N, 44°W, with 35-kn gales. On the 8th, the NORBROTT also found 35-kn gales south of the center. It was about this time that the circulation consolidated around the LOW, as the pressure dropped and the center took a northerly track. At 0000 on the 11th, Ocean Weather Station "C" measured 40-kn winds. On the 12th, the BAKHCHISARAY observed 20-ft seas at 56°N, 33°W. About this time, the center took an abrupt turn to the east and passed very near OWS LIMA. The LOW was weakening, as it slowly but steadily moved eastward and over Scandinavia on the 17th.

A very small, closed, 1008-mb isobar first identified this LOW, west of Lake Winnepeg, on the 3d. There was little development as the small circulation moved eastward, until late on the 4th. After passing the southern tip of James Bay, the storm started curving northward. At 0000 on the 6th, the 994-mb center was over Cape Chidley. Twelve hours later, it was over Cumberland Sound. A ship near 65°N, 55°W, had 45-kn

southerly winds blowing over very cold water. The waves were reported as 13 ft. To the south, near 62.5°N, 53°W, the WALTHER HERWIG had 40-kn winds stirring up 16-ft waves. The track of the storm continued curving westward, and this was the beginning of the end.

On the 4th, a cold front extended southwestward out of a LOW near Iceland. At 1200, a wave was analyzed, near 48.5°N, 26°W, with the aid of reports from the FORT PONTCHARTRAIN (30 kn) and the UGMJ (40 kn). Twelve hours later, at 0000 on the 5th, the central pressure of the LOW had plunged to 992 mb. The UGMX reported 35-kn gales west of the center, near 48°N, 30°W.

The LOW was moving northward with little change in pressure, but its circulation had expanded greatly. At 1200 on the 5th, the AMERICAN ARCHER, near 49.5°N, 19°W (fig. 33), was sailing into roaring 55-kn westerlies. The seas and swells were 20 ft. The

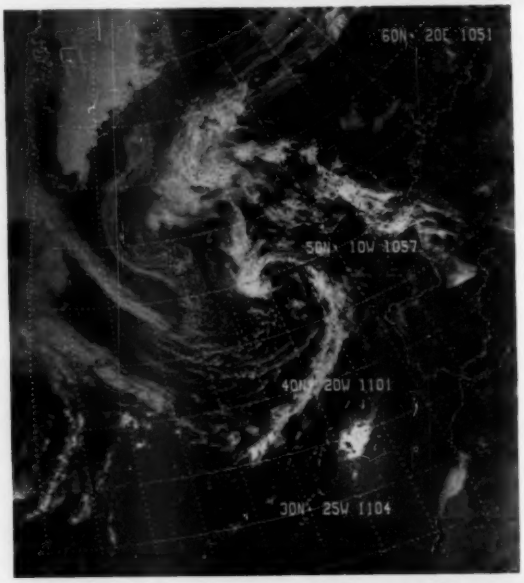


Figure 33.--The center of the LOW is near 50°N, 20°W, and does not appear nearly as vicious as the 55-kn winds indicate. The bright spot near 35°N, 18°W, is sun glint off the sea.

SEA-LAND PRODUCER was near 48.5°N, 29°W, with 35-kn gales. Several ships around the storm reported 30-kn winds. At 1200 on the 6th, the SWEDISH PLANE was blown by 35-kn southwesterlies.

The LOW moved toward the north and passed over the western peninsulas of Iceland, on the 9th, with only weak winds. The storm continued northward, to disappear over the Greenland Sea on the 12th.

This system had its origin in several sources. One was a frontal wave that developed over Kansas, on the 13th, and moved eastward along the front until it was a 1006-mb LOW south of Nova Scotia on the 19th. Another source was a LOW that came out of central Canada to northern Quebec on the 19th. This was the larger of the two LOWs. The third element was a HIGH which had moved from the U.S. east coast to near 45°N, 40°W. At 1200 on the 19th, the CETRA COLUMBA was rolled by 40-kn southerlies on her port side, near the apex of an occlusion out of the southern LOW. The HUDSON was north of Notre Dame Bay, with 35-kn southerlies ahead of the front out of the Canadian LOW. At 1200 on the 20th, the SEA-LAND RESOURCE was near 50°N, 40°W. The winds were 35 kn out of the south, with 15-ft seas. By the 21st, the smaller LOW was absorbed by the larger circulation.

This storm came out of Nebraska. It picked up some energy as it crossed the Great Lakes on the 21st. Late on the 22d, it moved offshore of Nova Scotia at 1002 mb. It quickly developed over the water and, at 1200 of the 23d, was 988 mb near Cape Race (fig. 34). The ATLANTIC CHAMPAGNE was southwest of the center, near 45°N, 57°W, and being battered by 50-kn winds. The waves were 15 ft. Just a few miles away, the VIKTOR LYAGIN radioed 40-kn winds and 13-ft waves. Twelve hours later, the center was near the Virgin Rocks, and the ALINDA, near 50°N, 49°W, fought 40-kn northerly winds.

At 1200 on the 24th, the 980-mb center was near 49°N, 45°W. The GYPS, at 54°N, 41°W, was north of the occluded front, with 45-kn northeasterly winds. The IVAN AIVAZOVSKY, north of Newfoundland, suffered 40 kn, and the VC 8062, off St. John's, had only 35 kn, but the swells were running 20 ft.

As the LOW continued northeastward, gales were reported in all quadrants. The NEW ENGLAND TRAPPER (49°N, 38°W) had 35-kn gales and 23-ft swells,

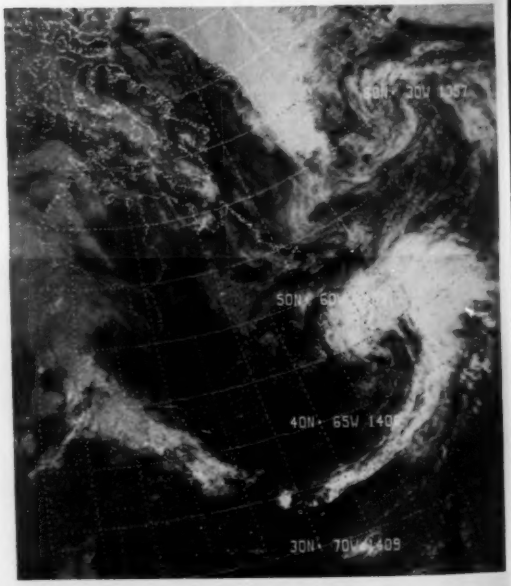


Figure 34.--The largest area of clouds is north and east of the center of the LOW. The cold front stretches westward to the north central United States.

south of the center. At 0000 on the 26th, the LINDA DAN sailed within a few miles of the 986-mb center and into 45-kn winds, with 21-ft seas. As the storm approached Iceland, it was weakening rapidly, and the passage over the island spelled the end.

A LOW was analyzed over Lake Michigan, on the 1200 chart of the 29th. It moved due east and off the coast, at 1800 on the 30th. At 0000 on the 31st, the FRITHJOF encountered 35-kn gales off Cape Cod. At 1200, the 1004-mb LOW was at 41°N, 60°W. The BILDERDYK, about 60 mi north of the center, sailed into 40-kn winds and 13-ft waves. She was sailing northeastward at about the speed of the LOW and, at 0000 on September 1, still had 40-kn gales. The seas were running 13 to 15 ft. On the 2d, the GEORGE WALTON and NORDIC TALISMAN both had 35-kn gales, west and south of the center, respectively.

The LOW turned northward to pass over Newfoundland, on the 3d, as hurricane Doris, to the southeast, moved northward (fig. 35).

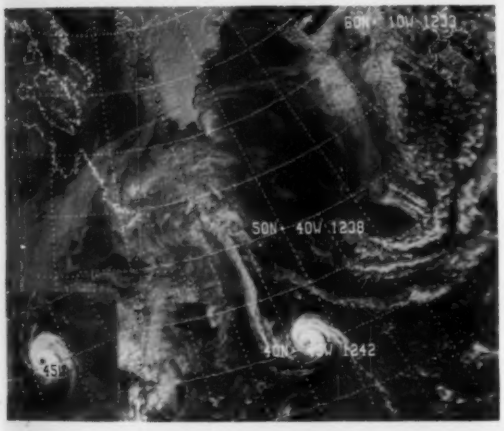


Figure 35.--The clouds associated with the extratropical LOW are not well organized. A low-level feeder cloud stretches southward into hurricane Doris. The inset in the lower left corner is how Doris looked in infrared.

Tropical Cyclones--Late August saw hurricane Caroline come to life in the Gulf of Mexico, and hurricane Doris develop in the northern North Atlantic.

Caroline began as a weak tropical wave. Satellite pictures, on the 28th, suggested that she was becoming organized. An Air Force plane was sent out to investigate and found tropical storm Caroline some 400 mi east-southeast of Brownsville, Tex. She was heading toward the west-northwest. The threat to the Texas coast was compounded by the upcoming Labor Day weekend, with its numerous seashore activities. Caroline plodded on. By Friday morning, the 29th, she reached hurricane intensity about 275 mi east-southeast of Brownsville. Winds climbed to 65 kn around her 995-mb center. For awhile, on Friday, she was stationary. Then, Saturday morning, she began to move westward toward the Mexican coast and continued to intensify. At 1300 on the 30th, the hurricane was 200 mi southeast of Brownsville. Winds climbed to 100 kn around her 963-mb pressure center before Caroline reached the coast, midway between Tampico and Brownsville, early Sunday Morning (1000). She spread heavy rain throughout northeastern Mexico and into southern Texas (fig. 36). Storm totals of 10 in were common, as the decaying storm turned northward after landfall. On Sunday alone, Brownsville recorded 5 in of rain. The rains continued through Monday, as the system made its way into south Texas.

Doris began as a small subtropical LOW in the middle North Atlantic on the 27th. It was not until late on the 30th that she acquired tropical characteristics, near 35°N, 46°W. She was already of hurricane intensity, as 65-kn winds roared around a 990-mb center. Gales extended out 150 mi in all directions. The IRISH MAPLE, some 50 mi or so south of the center, encountered 40-kn southwesterlies. Maximum winds climbed to 75 kn, as Doris briefly swung east-southeastward on the 31st (fig. 36). Moving northward, Doris reached peak intensity, on the 3d, when maximum winds were estimated at 95 kn, with gales and 15-ft-plus seas extending out 150 mi in all directions. However, cold air was intruding, and Doris began to weaken and turn extratropical, on the 4th, after crossing the 40th parallel near 43°W.

Casualties--There are no weather-related casualties known at this time.

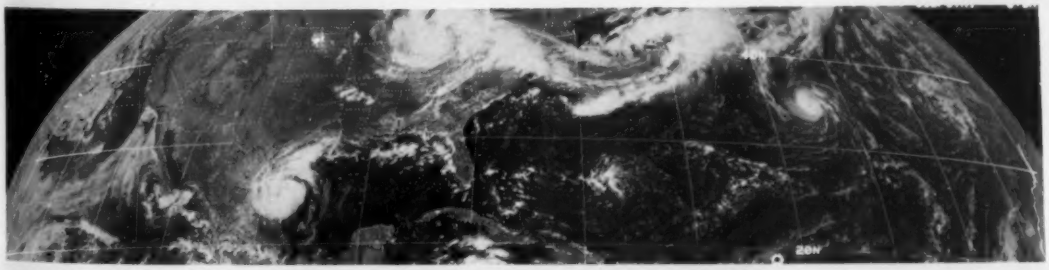


Figure 36.--On the 31st, at 1200, Caroline creases the coast of Mexico, while Doris churns away far out in the North Atlantic, near 35°N, 45°W.

ROUGH LOG, SEPTEMBER 1975--The storm track pattern was near normal this month, although, in general, they were depressed about 5° latitude south of their climatological average. The main track that affected shipping came across the Great Lakes to northern Newfoundland and then toward Iceland. Another track was from the north central ocean (45°N, 30°W) to Scotland and Norway. From a quick glance, it appears that more of these occurred during the last half of the month than the first half. The storms that affected the Labrador Sea and Baffin Bay area seemed to prefer the first part of the month.

As usual, the largest feature on the mean sea-level pressure chart was the Azores High at 1026 mb, centered near 37°N, 33°W. This was 5 mb higher than normal. The main Icelandic Low center was 995 mb over the Greenland Sea, many miles from its normal 1005-mb center near 61°N, 30°W. A 1002-mb LOW was centered near that position.

The main area of the North Atlantic of interest to shipping (25° to 60°N) was ruled by positive anomalies. The center of the major positive anomaly was 6 mb, near 40°N, 30°W. The primary negative anomaly was 13 mb, south of Spitsbergen. There was also a 4-mb negative anomaly near 15°N, 35°W.

The main upper-air flow was zonal, with troughing over the Great Lakes and the coast of Europe. The height of the 700-mb surface was higher across the 30°N latitude belt and lower over the Arctic. The primary LOW was normally located over northern Ellesmere Island, but an abnormal LOW reflected the surface LOW over the Greenland Sea. Most of the ocean between 25° and 60°N, except over the European coast, reflected positive anomalies.

September's storms--Eloise, Faye, and Gladys--were all hurricanes. They kept the North Atlantic area active from midmonth on. Only Eloise reached the United States. Faye stayed well out in the Atlantic, while Gladys threatened the East Coast before recurving.

Extratropical Cyclones--The track of this LOW can be traced from the central North Pacific and across Alaska and Canada. At times, it became very weak, but a center could always be found. It moved across Labrador and into the sea on the 16th. The LOW raced across the Labrador Sea to join and reenforce an old LOW south of the Denmark Strait, late on the 17th. The LOW remained quasistationary and deepened. At 1200 on the 19th, the pressure was 985 mb. The SNORRI STURLUSON was at 64.5°N, 35°W, and battling 50-kn winds (fig. 37). Two other fishing vessels in the vicinity reported 45-kn winds.

On the 20th, the LOW started moving eastward in the wake of a northward-moving storm, which quickly absorbed it on the 21st.

A front had pushed south to about 30°N. As the HIGH behind the front moved seaward, a wave formed on the front just off the coast, and, by the 17th, a closed circulation had formed around the apex off Cape Hatteras. It moved eastward, deepening slowly. At 1200 on the 19th (fig. 37), the 996-mb center was near 40°N, 50°W. The ATLANTIC FOREST was in the southwestern quadrant (38°N, 53°W), sailing east-northeastward with 45-kn winds and 20-ft waves. South of the center, the HOHKOKUSAN MARU, MINERAL OUGREE, and PRO-

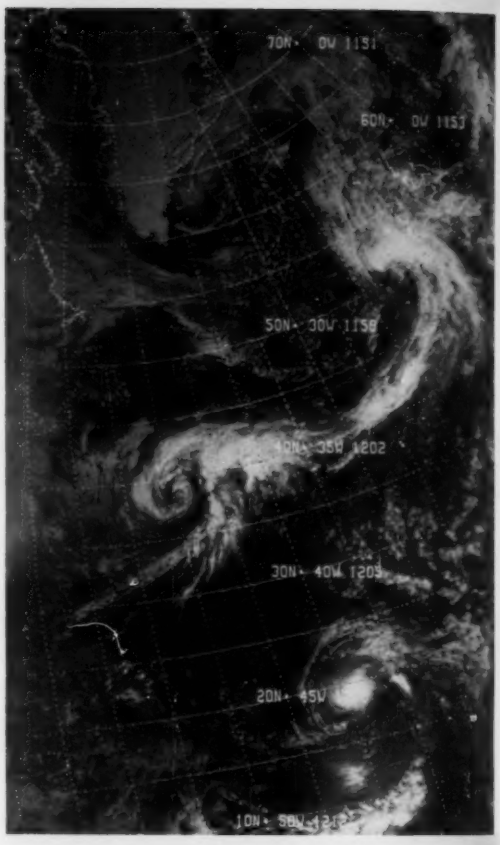


Figure 37.--The LOW south of the Denmark Strait does not show up well in this visual image due to the low elevation of the sun. The center of the LOW off Cape Hatteras appears further south than the chart indicated. Tropical storm Faye is near the bottom of the picture (20°N, 40°W).

PONTIS contended with lesser gales. Twelve hours later, gales were being reported all around the center, with the CETRA COLUMBA contributing 40 kn.

At 1200 on the 20th, the PROPONTIS was being pushed by 50-kn winds. The AMERICAN ALLIANCE (43°N, 45°W) was in the northwestern quadrant, with 45-kn gales. On the 21st, the LOW turned northward to a northeasterly track. It was now invading the circulation of an Arctic LOW moving along 60°N. The stronger northern LOW rapidly absorbed the circulation of this LOW, but it managed to retain its identity as a frontal wave until the 24th, over Norway.

A LOW sprang from Hudson Bay on the 19th. It moved due east along the 60th parallel. The SEDCO 445, north of Hopedale, reported 40-kn winds, at 1200 on the 20th, when the 996-mb center was at 60°N, 55°W. As the LOW center passed over Kap Farvel, the weather station there reported heavy snow.

At 0000 on the 22d, the pressure had decreased to

980 mb at 61°N, 31°W, and the SVENDBORG radioed 45-kn winds near 60.5°N, 33°W. The ANNA JOHANNE, at 59.6°N, 40.4°W, had only 35-kn winds, but the seas were raging at 23 ft. Twelve hours later, the SVENDBORG suffered 50-kn winds. A frontal system from a peripheral LOW to the east was bringing 40-kn gales to the Shetland Islands and the North Sea.

On the 23d, the center was south of Iceland, and the LETCHWORTH, east of the Outer Hebrides, was headed into 50-kn westerlies driving 26-ft waves. The seas south of the center were reported as 25 to 28 ft by several ships, including OWS LIMA. On the 24th, the LOW raced to join another LOW over Norway, as a third LOW approached from the west.

This storm was generated over the Gulf of St. Lawrence, near the triple point of an occlusion, on the 22d. By the time the storm was 24 hr old, it was developing 50-kn winds, as reported by the DAGHESTAN near 52.5°N, 49.5°W. The LOW was near 53°N, 47°W, at 994 mb. The HANNOVER was near 49°N, 42°W, with 40-kn gales. Twelve hours later, at 0000 on the 24th, she was near 50°N, 38°W, and being buffeted by 60-kn winds on her stern. The LOW was racing eastward at over 50 kn, with ships suffering momentary high winds as the LOW passed north of their track (fig. 38). At 0000 on the 25th, the 978-mb LOW was over northern Scotland. The west coasts of the British Isles suffered gale-force winds. At that time, the track turned northeastward to parallel the coast of Norway.

The LOW was still deepening and, at 1200 on the 27th, was 965 mb off Lofoten, Norway. OWS MIKE was tossed by 50-kn winds and 25-ft seas. Winds of 35 to 45 kn were common along that coast. On the 28th, Spitsbergen had 45-kn gales from the northeast. The center of the LOW then moved into the vicinity of the island, where it remained until the 31st.

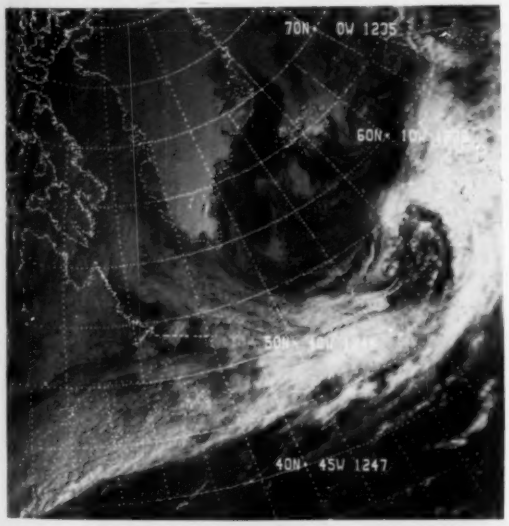


Figure 38.--The high winds of the jet stream, under which the LOW sped eastward, stretch from New England to England.

Early on the 25th, there was a col area in the circulation south of Greenland and east of Newfoundland. By 1800, a LOW had developed, and, at 0000 on the 26th, it was 993 mb, with a well-developed circulation. The 1200 chart showed the LOW at 47.5°N, 20°W, with gales in all quadrants. The DART AMERICA fought 40-kn winds and 16-ft waves, 400 mi west of the center. Farther west, another British vessel had 40-kn winds and 25-ft waves pounding her port side. Just prior to frontal passage, OWS ROMEO also measured 40 kn.

On the 27th, the LOW was moving northeastward over Ireland, and Lands End had 40-kn winds. The LOW continued that same track and was over Finland, on the 28th, and no longer a danger to shipping.

A stationary front paralleled the U.S. east coast north to New Brunswick, where it turned east-southeastward on the 28th. Hurricane Faye was approaching Nova Scotia from the south. At that time, a closed circulation developed where the front bent eastward. As hurricane Faye turned eastward, this LOW developed and followed in her wake. At 1200 on the 29th, the IMPERIAL QUEBEC was swept by 45-kn winds off Cabot Strait, and the AXEL battered into 45-kn winds and 16-ft seas northeast of the center, which was about 100 mi east of St. John's.

The extratropical LOW was now far larger than Faye, which turned extratropical on the 29th. On the 30th, among others, the HASSELBURG found 45-kn gales and 20-ft seas near 41.5°N, 44°W, or about 400 mi southwest of the center.

On October 1, the EL LOBO was 200 mi west of the 990-mb center (45°N, 28°W), with 50-kn winds and 23-ft seas pounding her starboard side. Other ships were reporting 40- to 45-kn winds both to the north and south. On the 2d, the remnants of Faye disappeared. The SCHAUWENBURG, near 42°N, 32°W, had 45-kn northerly winds. She was also fighting 21-ft seas and 26-ft swells from the west-northwest. On the 3d, the LOW crossed the North Sea out of the area of interest.

Tropical Cyclones--On the 11th, ship reports showed a fairly large circulation in the tropical Atlantic, around 45°W. Air Force reconnaissance, on the 13th, found light winds and a pressure of about 1013 mb in the depression. The developing storm moved west-northwestward, which took its center about 40 mi north of Barbuda, easternmost of the Leeward Islands, late on the 14th. Most of the clouds and weather were located east and south of the center. Rainfall totals ranged from about 2 to 10 in over the Leewards and the Virgin Islands. The highest wind was only about 20 kn. The depression passed about 25 mi north of St. Thomas and St. John, about midday on the 15th. On the 16th, Eloise finally reached tropical storm strength as she continued west-northwestward to the north of Puerto Rico (fig. 39). Strongest winds were north and east of the center, so the island was spared strong winds. A few locations had gusts to 35 kn. However, heavy rains triggered floods throughout Puerto Rico. On the 16th, major flooding occurred on 19 rivers, with many severe flash floods--especially in the western sections, where they caused numerous rock falls and landslides. The result was 34 deaths and damage in excess of $60 million. Storm

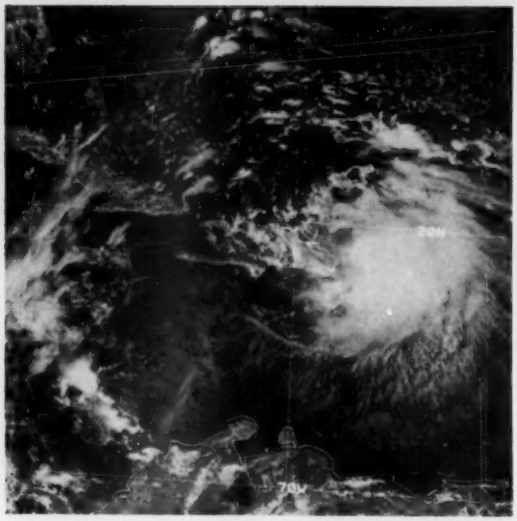


Figure 39.--While the strongest winds were to the north and east of the center, it is apparent that much of the cloudiness, and hence the heavy rain, lay to the south.

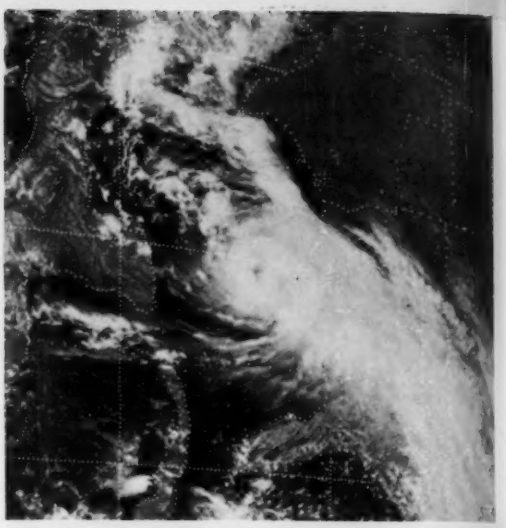


Figure 40.--At 1700 on the 22d, Eloise's winds were estimated at 74 kn close to her 985-mb center.

rainfall from the 15th through the 17th was quite variable. It was highest in the southwest where up to 27 in of rain fell, while some 20-in totals were recorded in the east.

Heavy rains that fell over the Dominican Republic broke a drought, although there was some crop damage, and seven people died. Heavy rains also triggered flooding over Haiti and caused 18 deaths. Eloise skimmed across the northern part of Hispaniola as a hurricane on the 17th.

Her trek across this rugged terrain took its toll. Eloise was a minimal hurricane before she moved across eastern Cuba. This overland journey weakened her further before she limped into the friendly confines of the Caribbean. Torrential rains continued to be her most devastating feature. She intensified slowly on the 19th and 20th. However, before hurricane intensity was regained, Eloise slammed into the Yucatan Peninsula on the 21st. Turning northward, Eloise made it into the Gulf of Mexico and blossomed. By the 22d, she was once again a hurricane. She crossed the 25th parallel just east of 90°W (fig. 40). Eloise grew. On the 23d, the EXXON SAN FRANCISCO, 100 mi west-northwest of Eloise's center, reported 70-kn winds, while the BARRANCA encountered 55-kn northerlies, 100 mi to the northwest. The storm passed close to the NOAA buoys EB-04 and EB-10, where winds surpassed 70 kn, and seas higher than 40 ft were measured. (See page 348.) Winds near the 957-mb center were estimated at 110 kn.

Eloise moved ashore just east of Fort Walton Beach, Fla., about midway between Pensacola and Panama City, at about 1200 on the 23d. Fort Rucker, Ala., northwest of Dotham and about 80 mi inland, recorded the strongest winds. Sustained winds there reached 90 kn, with gusts to 104 kn. Peak gusts reached 95 kn at Crestview, Fla., and 80 kn at Eglin AFB, Fla., and Pensacola. The lowest pressure of any land station was 957 mb, at Eglin, which also measured 13 in of rain during the storm. Eloise moved rapidly northward through Alabama. Wind gusts of 40 to 50 kn occurred over eastern Alabama and western Georgia northward to eastern Tennessee. As Eloise reached Tennessee, she became part of a large, complex, low-pressure and frontal system that dumped heavy rains over the eastern part of the country from the lower Mississippi Valley through the mid-Atlantic States and into New England. This system was responsible for almost a week of rain, which was heavy at times, triggering flooding and flash flooding. Some of the worst floods occurred along the Monocacy River in northern Maryland (fig. 41) and the Susquehanna River in central Pennsylvania. These rivers crested at up to 14 ft above flood stage. Sections of New York State were also hard hit.

Faye became a tropical storm, on the 19th, near 20°N, 40°W. She moved westward for several days, as maximum winds near her center reached 40 kn. However, on the 23d, a reconnaissance plane flew into the system and registered winds of 20 kn or so. Downgraded to depression status near 20°N, 55°W, Faye took a turn for the better--she headed northward. By the 25th, another look indicated the patient was recovering. Faye was a tropical storm again, and conditions looked right for further development. Later in the day, about 480 mi southeast of Bermuda, she became a healthy hurricane. Winds continued to climb; pressure kept falling. As Faye neared Bermuda, 85-kn winds roared around her 980-mb center. When she passed 40 mi east of the island, on the 26th, winds at Kindley Field gusted to 42 kn. Atop a 100-ft tower, sustained winds blew at 40 kn, with gusts to 60 kn. Faye was moving toward the northwest and continued to do so until the 27th, when, about 350 mi southeast

Figure 41.--The Patapsco River, near Ellicott City, Md., roared out of its banks on the 26th. It is shown here washing over Frederick Road near the Baltimore-Howard County line. Wide World Photo.

of Cape Cod, she recurved toward the northeast (fig. 42). On the 28th, several ships suffered from Faye. The HASSELBURG, 120 mi southwest of her center, and the ZVIR, close to it, both encountered 50-kn winds. The SEA-LAND MARKET ran into 55-kn winds in 25-ft seas, about 180 mi south of the storm center. Moving east-northeastward over cooler waters, Faye was turning extratropical. However, she remained potent.

Faye was embedded in the warm sector southeast of a large extratropical storm, like a chick tucked under the wing of a mother hen. By the 30th, she had completed the extratropical transformation. At 1200, the central pressure had risen to 990 mb near 44°N, 27°W. The SCHAUWENBURG was 200 mi east of the center, with mild 25-kn winds and 12-ft seas, but the confused swells were 26 ft. On the 1st, she was dis-

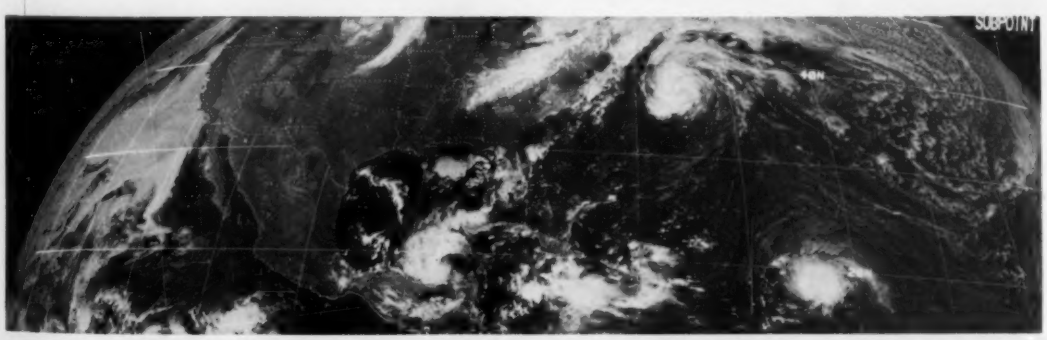


Figure 42.--Faye (north) and Gladys are both hurricanes, at 1200 on the 27th. A tropical depression is over the Yucatan Peninsula.

sipating rapidly (1003 mb) and, on the 2d, could no longer be analyzed.

Gladys was spawned by the ITCZ in the eastern North Atlantic on about the 22d. She reached tropical storm strength, on the 24th, near 14°N, 41°W, and hurricane strength the following day. Moving west-northwestward, Gladys maintained minimal hurricane strength for several days. Then, on the 29th, as she turned toward the northwest, Gladys blossomed. On the 30th, winds reached 85 kn. By the 1st, as she crossed the 30th parallel near 73°W, they were roaring at more than 120 kn around a 940-mb pressure center. By this time, Gladys was swinging northward and becoming less of a threat to the United States. She continued recurving and maintained her awesome intensity into the 2d. The S. L. 180, some 120 mi east-southeast of her center, was brushed by 50-kn winds on this day. Gladys was the most intense hurricane to cross the western North Atlantic this far north in the past 15 yr. As she crossed the 40th parallel, near 65°W, her fury began to abate somewhat, and cold air started to intrude. Accelerating rapidly northeastward, Gladys whizzed by Cape Race, on the 3d, at about 45 kn. Winds near her center were dropping, but still around 95 kn. She completed her extratropical transformation late that day. At 1200 on the 3d, she was only a few miles west of VC 8062, where the winds were measured at 50 kn, with swells of 20 ft.

A LOW which had developed on a front to the west was centered over St. John's. At 0000 of the 4th, Gladys combined with the extratropical LOW, which sped off toward the northeast. At 1200, the C. P. TRADER experienced 50-kn winds at 55°N, 34°W. Slightly to the south, OWS CHARLIE had 35-kn gales and 20-ft waves. Just ahead of the cold front (55.5°N, 28°W), the DAGHESTAN was sailing with 55-kn winds, 16-ft seas, and 28-ft swells. On the 5th, the 976-mb storm raced across Iceland, treating OWS LIMA to 45-kn winds, 23-ft seas, and 28-ft swells. The deep storm continued into the Norwegian Sea. The 11,491-ton Venezuelan MARACAIBO, New York to La Guaira, arrived with heavy-weather damage to cargo, done by Gladys off the southeast coast of the United States.

Casualties--The barge CAYMAN 2200, in tow by the tug RUMPOINT, broke away in heavy weather on the 5th. The barge and many of its cargo of telephone poles washed onto a reef. The Panamanian-registered, 6,338-ton FLORIDA STATE ran aground in the river at Tampico, on the 22d. Winds and an 8-kn current caused suspension of assistance by tugs. Tugs had to wait for high winds to abate off Veracruz, Mexico, before attempting to tow the 3,430-ton German MAGDALENE VINNEN, which had grounded on a reef in bad weather.

Rough Log, North Pacific Weather

August and September 1975

ROUGH LOG, AUGUST 1975--The storms this month originated farther north than normal, south of Kamchatka rather than off Honshu. These tracked eastward along the Aleutians and into the Gulf of Alaska rather than the Bering Sea. The midocean, 35° to 40°N, 180°, contributed more storms than usual, and they generally moved northeastward.

The mean sea-level pressure pattern was near normal in overall appearance, but the minor differences made the difference. The Pacific High was near 40°N, 150°W, its normal location, but was 4 mb higher, at 1028 mb. There was no closed Low over the Bering Sea to match the usual 1008-mb center, but the pressure over the Gulf of Alaska was less than the climatic mean.

The largest positive anomaly was 5 mb off the northern California coast. The ocean area from the U. S. west coast southwestward to beyond 180° was covered by higher than usual pressure. A positive 4-mb was centered over the Bering Sea, near 60°N, 175°W. The southern Gulf of Alaska supported a negative 3-mb center; the western Sea of Okhotsk, a negative 6-mb; and a negative 5-mb was near Taiwan.

The monthly mean height of the 700-mb surface was slightly higher than climatology across the vast majority of the ocean, except for the Gulf of Alaska and the seas off southeastern Asia. The negative anomaly over the Gulf of Alaska was because of a short wave trough in the monthly mean over that area.

There were five tropical cyclones over the eastern ocean--tropical storms Georgette and Hilary, and hurricanes Ilsa, Jewel, and Katrina. The western ocean hosted four tropical cyclones: typhoons Ora, Phyllis, and Rita, and tropical storm Susan.

Extratropical Cyclones--An old, weak front extended east-west along the southern Alaska coast, on the 7th, as a minor north-south trough moved eastward across the gulf. On the 8th, a distinct LOW formed over the Kenai Peninsula. By 1200, it had moved southeastward into the gulf. Ocean Weather Station "P" measured 40-kn winds at that time. The LOW did not have a good energy source or upper-air support; therefore, it did not intensify, but drifted in the area until overtaken by a more vigorous LOW on the 10th.

The lineage of this storm can be traced back to beyond the 1st and interior Asia. This particular LOW formed on the periphery of the old system, on the 6th, near Mys Lopatka. On the 7th, Ostrov Paramushir measured 40-kn northerly winds. The LOW moved steadily eastward, with no significant winds or waves until the 11th.

On the 10th, the Pacific HIGH had split into two cells, with the eastern one moving to off the United States-Canadian coast on the 11th. This blocked further eastward movement of the 990-mb LOW. Several 35-kn winds were reported between the HIGH and the

northern California coast.

On the 12th, the CHINA BEAR had passed eastward through the front near 42°N, 146°W, and encountered 35-kn southerly winds. The PORTLAND, in the gulf, also had 35-kn winds. The SEA-LAND COMMERCE was near the LOW's center, at 52.5°N, 157°W, and found 33-ft confused swells (fig. 43). The PORTLAND was steaming southeastward into 40-kn gales, at 0000 on the 13th. They were accompanied by an obscured sky and heavy drizzle.

The LOW was now moving west-northwestward and, on the 13th, was once again over the Bering Sea, where it rapidly deteriorated.

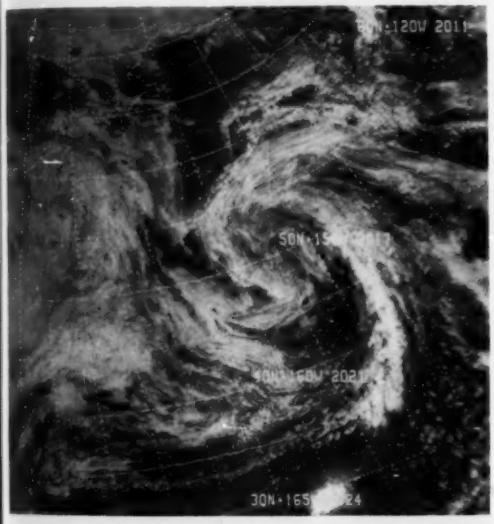


Figure 43.--The major part of the ocean north of 35°N has broken-to-overcast skies. There is an interesting area of clear skies south of the Fox Islands, with a plume of low clouds stretching south from near Unimak Island.

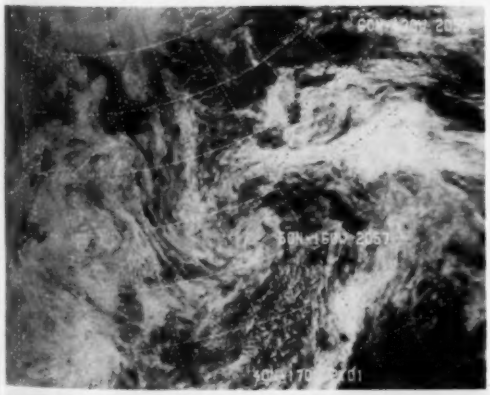


Figure 44.--The northern ocean continues to be mostly cloudy.

This low-pressure area developed, on the 17th, on the east side of another LOW that had stalled north of Adak Island. Far to the south along the front (42°N, 164°W), the RU YUNG encountered 35-kn gales. The LOW remained quasistationary near 55°N, 168°W, at about 997 mb. A frontal wave moved around the edge of the system, and the two combined, on the 18th, near 55°N, 164°W. The KOREAN MAIL was near 50.5°N, 163.5°W, at 0000 on the 19th (fig. 44), and was rocked by 45-kn winds with 10-ft waves on her stern. Later that day, the storm moved northward, then eastward, to dissipate on the 20th.

The Tatar Strait produced this LOW on the 17th. After crossing the Kuril Islands on the 18th, the TOYOTA MARU reported 35-kn gales ahead of the front, near 48°N, 163°E. As the 990-mb storm moved eastward, several ships calculated 16-ft waves to the south of the center. One of these was the AKAISHI MARU, south of Amchitka Island, with 35-kn winds and 16-ft swells. At 1200 on the 20th, the seas were 16 ft and the swells, 30 ft, from the east.

The front was now running well east of the LOW (49°N, 178°E), and the HIEI MARU and PLUVIUS both found gales ahead of the occlusion. Several frontal waves and minor LOWs had been moving around the outer circulation of the storm. These had the effect of alternately tightening and loosening the gradient, depending on the position. At 1200 on the 22d, the BREWSTER was about 400 mi south of the 1000-mb center, which was near Adak Island. She was battered by 55-kn following winds and 15-ft waves. The LOW disintegrated, on the 24th, under the pressure of two large HIGHs.

A LOW tracked out of Manchuria and headed northward over the Sea of Okhotsk on the 22d. It had deepened to about 978 mb, by late on the 24th, when it crossed into the East Siberian Sea. Southerly winds were blowing along the northwestern Alaskan coast. Late on the 25th, another LOW (983 mb) formed over the Chukotskiy Peninsula. The gradient over the Bering Sea and northwestern Alaska was now very tight, producing strong southerly to southwesterly winds.

As the new LOW moved northwestward off Point Barrow, on the 26th (fig. 45), its pressure dropped to 970 mb, with westerly winds over the Chukchi and Bering Seas. The geostrophic wind measured 70 kn, and there were reported winds as high as 60 kn. Three barges went aground near Wainwright, Alaska. They were part of a flotilla of barges attempting to deliver oilfield cargo to Prudhoe Bay. The barges had been delayed due to ice along the coast southwest of Point Barrow. All the barges were later refloated, with extensive damage to one reported. There was considerable flooding along the south coast of the Seward Peninsula and the coast in Norton Sound. The village of Teller had to be evacuated, and there was flooding of homes and basements in other coastal towns. Cape Lisburne had 56-kn winds, and a radar site recorded 65 kn.

The deep LOW moved rapidly, especially for one so far north, to near 78°N, 140°W, by 1200 on the 27th. Strong westerly winds were still blowing along Alaska's north coast, but slackened on the 28th.

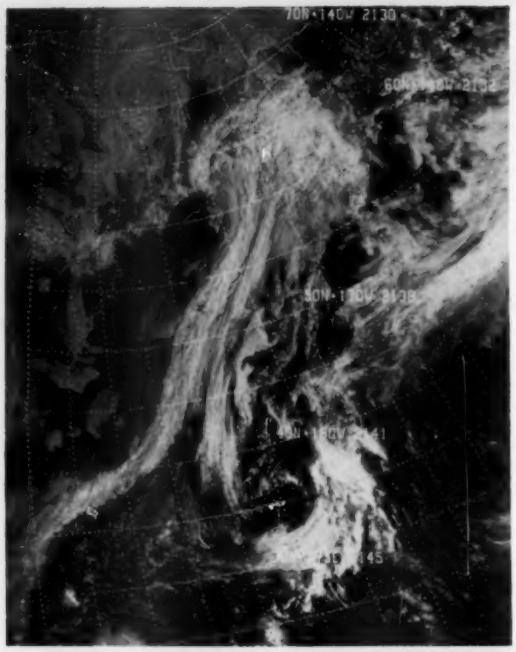


Figure 45.--At 2134 on the 25th, the LOW is slightly west of the Bering Strait. The circulation over the Siberian Sea can be seen faintly, near 70°N, 170°E. The sharp frontal-cloud band outlines the strong cold front.

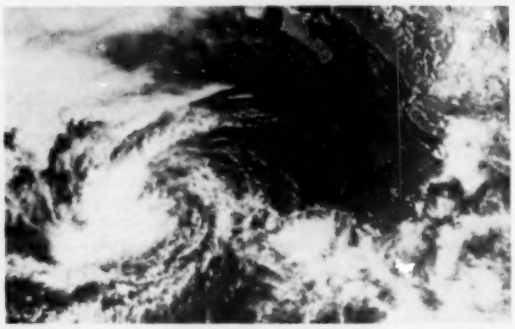


Figure 46.--Georgette was upgraded to a tropical storm, at 1800 on the 11th, the time of this picture.

Tropical Cyclones, Eastern Pacific--Georgette began as a tropical depression about 700 mi southwest of Cape San Lucas, late on August 10, with 25-kn winds, and headed westward at about 5 kn. Tropical storm intensity (fig. 46) was reached 24 hr later, near 14.7°N, 120°W, when the course curved gently northwestward, and the speed increased to 8 to 10 kn. Maximum winds of 40 kn were indicated from 0600 on the 12th to 0000 on the 13th, when slow weakening began.

The track then curved westward again, with a forward speed of 10 to 12 kn, reaching 17.4°N, 125.3°W, at 0600 on the 13th, when the intensity dropped to the tropical depression stage. Further weakening continued, through 0600 on the 14th, and bulletins were discontinued.

No reporting vessels approached closer than 300 mi of the cyclone.

The gradual organization of a tropical disturbance, near 11°N, 103°W, was noticed in satellite pictures on August 11. A circulation had developed by 1800 on the 12th. It was moving west-northwestward at 8 to 10 kn, and tropical cyclone Nine had formed near 11.4°N, 107°W, with 30-kn winds in squalls and thunderstorms near the center.

The depression increased to tropical storm intensity and was named Hilary at 0600 on the 13th. Winds of 40 kn were estimated from satellite pictures, and the center, moving northwestward at 10 kn, was indicated near 12°N, 109.5°W. The northwesterly movement continued, and its forward speed increased to 14 kn, as winds near the center increased to 50 kn, at 0000 on the 15th, near 16.5°N, 116°W (fig. 47).

Figure 47.--Tropical storm Hilary (17°N, 116.4°W) is following in the wake of Georgette, which is dissipating near 17°N, 137°W.

Weakening followed this northwesterly acceleration, with the center reaching 20.3°N, 121.7°W, at 1200 on the 16th, when the storm became a depression with 30-kn winds. The center then began curving west-northwestward as weakening continued. Dissipation was near 21°N, 124°W, at 1200 on the 17th.

Gale winds were reported by a vessel with 1007-mb pressure, about 100 mi northwest of the center, at 0000 on the 13th, while the cyclone was still classified as a depression. The GALILEO GALILEI, 150 mi south of the center, reported 15-kn winds at 0600 on the 13th. No other vessel reported within the circulation of the cyclone.

A disturbance that apparently crossed Central America between 8° and 13°N was followed west-northwestward from near 7°N, 83°W, beginning on the 16th. It was moving at about 20 kn, and a weak circulation was suggested by reports from the AMERICAN AQUARIUS and the DEVON CITY. Reports from the RIGOLETTO and DEVON CITY, at 1800, indicated it had moved to 9°N, 89°W, but the winds reported were only 5 to 10

km. By 1200 on the 17th, the disturbance was indicated by satellite pictures to be near 12°N, 94°W, and the windspeeds had increased to 10 to 20 kn, at points 100 to 150 mi from the center of the shower and thunderstorm activity. Six hours later, the PORTMAR and the ELISABETH BOLTEN added their reports indicating further intensification.

By 0000 on the 18th, reports from the UNIQUE FORTUNE indicated that tropical depression Ten had formed, near 12.1°N, 95.8°W, and was moving west-northwestward at about 8 kn. By 1200 on the 18th, the depression had intensified to tropical storm Ilsa, near 12.3°N, 97°W. Movement continued west-northwestward at 8 to 10 kn, but a more westerly track was observed as intensification took place. The storm became a hurricane near 14°N, 104°W, at 0000 on the 21st, on a course of 280° at 9 kn.

Intensification continued, with winds reaching 85 to 95 kn, from 1200 on the 22d through 0600 on the 25th (fig. 48). Ship reports were few--a Chinese vessel reported 30- to 40-kn winds as she passed 200 mi south of the center on the 23d.

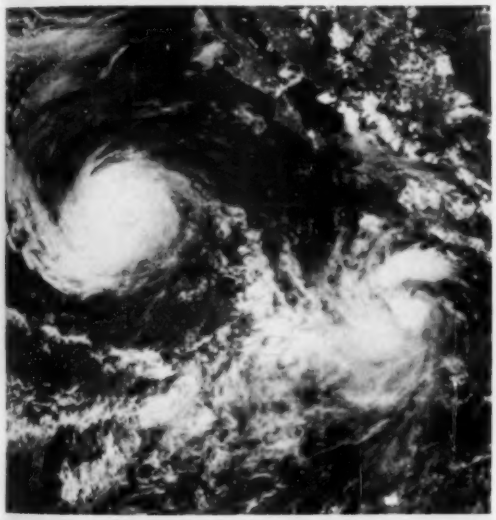


Figure 48.--Hurricane Ilsa, late on the 24th, is following the same general track as the two previous storms, but farther north than Hilary, which was farther north than Georgette, and at about the same longitude. Tropical depression 11 is organizing near 15°N, 105°W.

The track curved northwestward at 10 kn, from 1800 on the 22d through 1800 on the 24th, then westward again. Weakening began, at 0600 on the 25th, and was rapid. Ilsa became a tropical storm near 19.7°N, 126.1°W, at 0000 on the 26th, and a depression by 1800, near 20.3°N, 129.1°W.

The remnants of Ilsa were followed westward in satellite pictures and, with the aid of reports from the AVOCET, CHAO MING, HAWAIIAN MONARCH, MALLORY LYKES, MATSONIA, ORONSAY, PRINCE MARU No. 7, SHOZEN MARU, and the SILVEROON, to near 29°N, 153°W, by 1800 on the 31st, but no reports were for more than 25-kn winds.

Tropical storm appearance began again, on September 3, when VHRR (Very High Resolution Radiometer) pictures showed an intense circulation, complete with an eye, near 38°N, 158°W, with 35-kn winds reported by the HAGAOROMO MARU at 1800, 45-kn winds by the PLUVIUS, and 35-kn winds by the TRANSCOLORADO at 0000 on the 4th. At 0600 on the 4th, 55-kn winds were reported by the TRANSCOLORADO. The LOW then moved northeastward, through 0000 on the 6th, and dissipated in the eastern Gulf of Alaska.

The long period of hurricane winds--from 0000 on the 21st through 0000 on the 26th--and the regeneration to storm intensity north of Hawaii made Ilsa a unique storm. Such regeneration has never been so well documented in the eastern North Pacific area.

While Ilsa was churning her way northwestward 400 mi southwest of Cape San Lucas, a tropical disturbance formed about 300 mi south of Acapulco. Initial reports from the PRUD OCEANJET and the KRYPTOS indicated winds to 30 kn in squalls, at 1800 on the 23d, and suggested tropical depression Eleven had formed. The depression was moving west-northwestward at 12 kn, but slowed to about 5 kn, by 1800 on the 25th, and formed tropical storm Jewel.

The course changed to westerly at 5 to 8 kn, and intensification to a marginal hurricane took place by 1200 on the 27th (fig. 49). Slow weakening, and acceleration west- and northwestward, continued through 0000 on the 31st, to tropical depression strength near 19°N, 126.2°W. Bulletins on the depression were discontinued after 1200 on the 31st, but remnants of the circulation were still visible in satellite pictures until September 3.

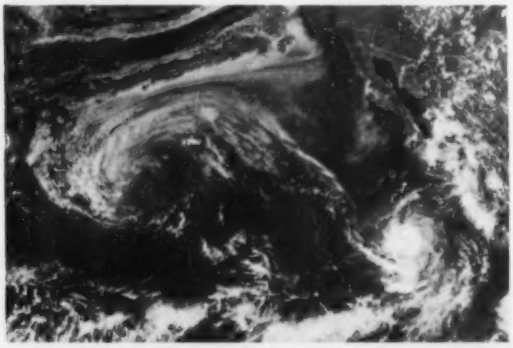


Figure 49.--Three days later, tropical depression 11 has intensified to hurricane Jewel, with Ilsa now only a depression near 21°N, 133°W.

Tropical storm Jewel was working her way westward some 400 mi southwest of Cape San Lucas, and Ilsa was a tropical depression 1,000 mi east of Honolulu, at 1800 on the 28th, when a rapidly developing tropical depression formed 400 mi south of Acapulco. Successive satellite pictures of Katrina indicated a west-northwestward 10-kn movement, and hurricane intensity was forecast within 48 hr. Hurricane strength was reached even sooner, at 1800 on the 29th, near 11.5°N, 103.7°W.

The track became more northwesterly, and gradual intensification continued until 80-kn winds were indicated when the center was 150 mi southeast of Socorro Island, at 1200 on September 1, and 115-kn winds when the center was 180 mi northwest of Socorro Island, at 1200 September 3 (fig. 50).

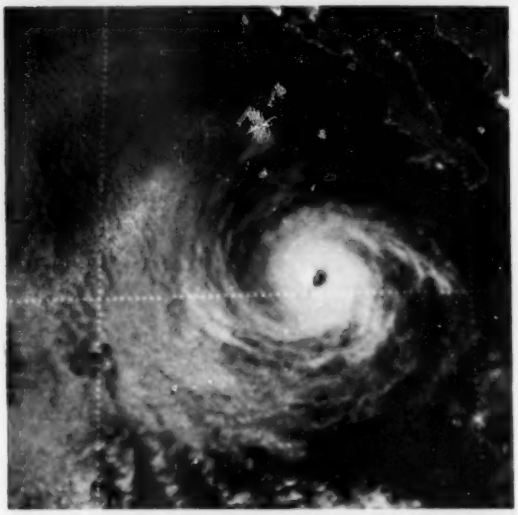


Figure 50.--Katrina had the highest winds--115 kn--of this series of tropical cyclones. At 1600 on September 3, her central cloud cover appears smaller, but better organized around the relatively large eye.

Weakening began, and the course became westerly following the peak intensity at 1200 September 3. The hurricane was downgraded to a tropical storm, at 1200 on the 5th, near 22°N, 121°W. Dissipation was almost as rapid as intensification, with tropical depression stage indicated by 1200 on the 6th. Bulletins were discontinued at 0000 on the 7th.

The lowest pressure reported near the center was at Socorro Island, at 0000 on the 2d, with a reading of 978 mb. This barometer reading appears to be 6 mb low when compared to vessels passing nearby, but an 85-kn wind was reported when Katrina was estimated to be only a few miles west of the island.

Few vessels encountered the hurricane or gale winds of Katrina. The DAPHNE reported 35-kn winds, 200 mi east-northeast of the center, at 0000 on the 3d.

Tropical Cyclones, Western Pacific -- Typhoon Ora developed near Taiwan. On the 10th, she was detected as a tropical storm about 200 mi east of southern Taiwan. Ora reached typhoon strength, the following day, as she headed northward into the East China Sea. Maximum sustained winds reached 70 kn, on the 11th, and the typhoon turned northwestward toward mainland China. On the 12th, Ora, at tropical storm strength, crossed the coast near Wen-chow.

Typhoons Phyllis and Rita brought death and destruction to Japan during one week in August. Both clobbered Shikoku and Honshu, while Rita caused the worst flooding in 10 yr on Hokkaido. At least 90 people died as a result of the two storms. Figures 51, 52, and 53 show these storms in action.

Figure 51.--The torrential rains from typhoon Phyllis resulted in a landslide which destroyed part of this small town on Shikoku, on the 17th. Winds of over 100 kn were reported to have hit the island. United Press International Photo.

On the 12th, Phyllis reached tropical storm strength, about 420 mi west of Guam. Moving northward, she developed rapidly. By the 13th, she was a typhoon, and, on the following day, maximum winds near her center were estimated at 115 kn. Gales extended out over 200 mi, as can be attested to by the NIPPO MARU, which encountered southerly 35-kn winds more than 200 mi east-southeast of the storm's center, early on the 15th. Winds of 100 kn or more continued near the center into the 16th, as Phyllis headed northwestward across the 30th parallel. Bearing 85-kn winds, the typhoon crossed southern Shikoku and Honshu, on the 17th, and continued into the Sea of Japan, where she slowly dissipated after heading northward along the 130th meridian. She left Shikoku reeling. Torrential rains caused flooding and devastating landslides. This resulted in an estimated 60 deaths on the small island. In addition, nearly 1,000 homes were destroyed or damaged.

While Phyllis was dying, Rita was coming to life a couple of hundred miles southeast of Okinawa, on the 18th. The tropical storm brushed the central Ryukyus, on the 20th, as she turned northeastward. The follow-

Figure 52.--High waves from typhoon Rita pound the beach and what appears to be a breakwater, at Ote Beach, Tokushima Prefecture, Shikoku, on the 22d. Photo courtesy of The Japan Times.

Figure 53.--This is how Rita appeared to the NOAA satellite a few hours before the previous picture of high waves at Ote Beach.

ing day, Rita was a typhoon crossing the 30th parallel (fig. 53). Ocean Station Vessel TANGO felt the sting of 40-kn southeasterlies, sailing some 180 mi east-southeast of Rita's center, on the 21st. Winds near her center climbed to 85 kn before she brushed the eastern part of Shikoku and moved across the Kii Strait and over Osaka. Rita lost her typhoon strength over-land and emerged a tropical storm in the Sea of Japan, south of Kanazawa. However, the storm recurved northeastward and recrossed Honshu in the north. She then moved along the coast of Hokkaido, generating torrential rains, which totaled over 8 in over a large area. This resulted in extensive flooding along the Ishikari River. Along with landslides, this resulted in eight deaths on Hokkaido.

On Shikoku, 15-ft waves pounded the beach at Tosa, while Cape Muroto registered peak gusts of 66 kn. Rainfall up to 9 in was measured on Shikoku, while the Kii Peninsula was pelted with 4 to 6 in of rain and gale-force winds. Gusts of 63 kn were recorded at Osaka, and 55 kn, at Tokyo. In the mountains of Honshu, up to 26 in of rain were reported.

Susan started her career late in the month and far out to sea. She formed near Marcus Island on the 24th. Remaining a tropical depression, she headed northward. She petered out, on the 27th, but reformed near

35°N, 153°E, on the 29th. As a tropical storm, she moved eastward, then northward, for a couple of days before becoming extratropical.

Casualties--The 1,597-ton South Korean freighter SUN STAR sank in rough seas resulting from typhoon Nina, off Taiwan's southwest coast, on the 3d. Thirteen crewmembers were rescued, one was killed, and nine were missing. The Panamanian WINSON (23,199 tons), which went aground in January at 11.5°N, 114.4°E, sank in heavy seas after being refloated.

The Panamanian ARIES ran aground and caught fire, near Salina Cruz, Mexico. During the nights of the 17th and 18th, the vessel swung broadside to the beach and was pounded by heavy swells.

ROUGH LOG, SEPTEMBER 1975--An average month! The storm tracks were spread from about 35° to 70°N, but there were areas where they were more dense than others. The favorite area of concentrated cyclogenesis was eastern Mongolia, from where they tracked into Siberia or the Bering Sea. Another average track was from Honshu eastward to about 175°E, and then northeastward toward the Alaska Peninsula. This track was more eastward than the normal climatological track. Another primary track was from north of the Hawaiian Islands (35°N, 160°W) into the Gulf of Alaska. This track originated farther south than normal.

The pressure pattern overall was near the climatological normal. There were two Low centers, 1006 mb over Bristol Bay and 1010 mb over the Sea of Okhotsk, which were within 2 mb of their climatological counterparts. The pressure over the western Bering Sea was above normal. The primary center of the Pacific High was 1025 mb, at 45°N, 136°W, about 750 mi northeast of its normal location. A second 1021-mb center was near 40°N, 178°W. The pressure along the North American coast, from California north, was above normal.

The major anomaly centers were positive. A plus 8-mb center was near the Queen Charlotte Islands, and an elongated north-south area of above 4 mb stretched from Wrangel Island to about 40°N, 180°. A negative 3-mb center was over the Sea of Okhotsk.

The major differences in the upper-air charts were a sharper trough southward from the Bering Strait, a sharp trough and small Low center off the California coast, and a small Low center over the Sea of Ohkotsk. The height of the 700-mb surface was above normal over most of the ocean except the Sea of Okhotsk. The primary positive anomaly centers were over the central ocean and off the British Columbia coast.

There were three tropical cyclones in the eastern North Pacific: hurricane Lily, tropical storm Monica, and tropical storm Nanette. In the western North Pacific, the tropical cyclones were typhoon Tess, tropical storm Viola, typhoon Winnie, typhoon Alice, and typhoon Betty.

Extratropical Cyclones--This LOW started out as an easterly wave and would have liked to have been a tropical cyclone. The center developed, late on the 1st, and moved northward. By 0000 on the 4th, it was near 43°N, 156°W, at 1000 mb. The PLUVIUS was near 41°N, 156°W, and found 45-kn gales. The TRANSCOLORADO was at 42°N, 153°W, with 35-kn gales. The storm continued moving in a north-northeasterly direction toward the Gulf of Alaska, but it was weakening. When it moved onto the Alaskan coast, on the 6th, it disappeared.

This was another storm that had its inception in the easterlies south of the Pacific HIGH. This one developed, on the 5th, near 33°N, 162°E, and also moved northward prior to turning eastward on the 7th. On the 8th, it combined with a cold front moving slowly eastward. This was a shot in the arm, and the LOW quickly developed into a storm. At 0000 on the 9th, it was 999 mb at 49°N, 172°W. The GRAND GLOBE was the first to report gale-force winds, near 50°N, 176°W. By 1200, the pressure had dropped to 982 mb. The SEA-LAND MCLEAN was at 50°N, 167°W, riding with 45-kn gales, 10-ft seas, and 26-ft swells. North of the Aleutians, the SHOYO MARU suffered heavy rain, with 40-kn north winds. The 16-ft seas were from 020°, and the 20-ft swells, from 090°.

At 0000 on the 10th, the 978-mb LOW was over the Fox Islands. The JAPAN MAPLE, directly south of the center, was swept by 45-kn winds. After crossing into the Bering Sea, the forward movement of the LOW slowed considerably, and it started filling. As it moved over land, on the 11th, it again picked up speed and could be traced across Canada into the Atlantic.

This was a short-lived storm. It started as a wave on a front oriented north-south from Bristol Bay, on the 16th. It raced northward to Bristol Bay and was 982 mb on the 18th. The KIYOSHIO MARU was south of Unimak Island with 35-kn gales, while the PACGLORY was near 53°N, 151°W, just east of the front, with only 25-kn winds, but a southerly swell of 33 ft (fig. 54). The LOW moved up the Yukon River on the 19th.

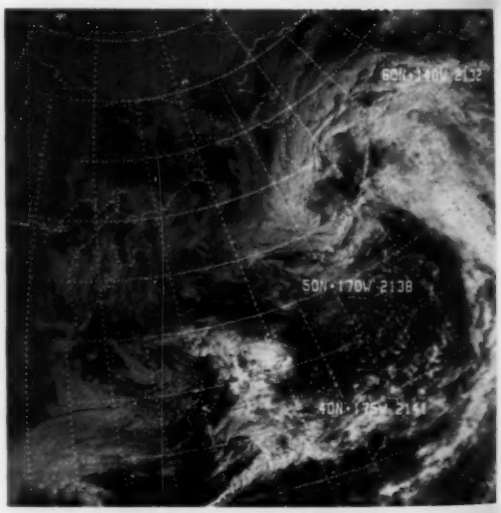


Figure 54.--The northward-moving LOW is south of Cape Newenham, late on the 17th. The front that spawned the storm stretches southward along 150°W.

Honshu contributed this storm, on the 18th. It moved eastward along the average monthly storm track. By 0000 on the 20th, the LOW was 1006 mb, near 41°N, 158°E. The EASTERN WORLD was near 44°N, 157°E, with 45-kn easterlies. The LOW continued eastward, taking on a southerly component as it moved south of a HIGH over the Aleutians. The winds were averaging 20 to 30 kn around a 1000-mb center.

On the 24th, the storm joined the eastern ocean storm track and turned northward. At 1200 on the 25th, the center passed within 60 mi of OWS PAPA, which reported 45-kn winds and 16-ft seas. A ship 200 mi south of PAPA reported 40-kn winds and 26-ft swells.

As the LOW moved into the Gulf of Alaska, it deepened dramatically, to 976 mb, based on a report by EB-03 (fig. 55). Only 30-kn winds were reported near the edge of the storm; no ships reported within 300 mi of the center. Even though there was large curvature to the isobars, the gradient supported much higher winds near the center. On the 26th and 27th, the storm stalled, near 57°N, 145°W, and died out.

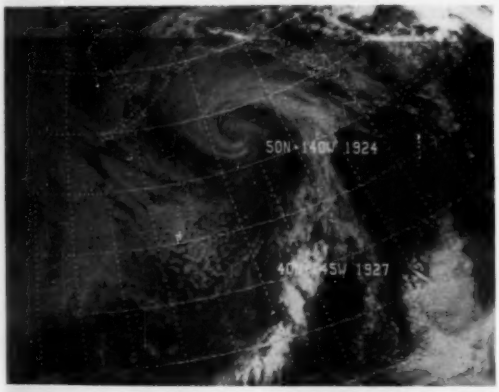


Figure 55.--The rapidly deepening storm displays the classic cloud pattern of an occluded frontal system.

While the last system was moving toward the Gulf of Alaska, this one was just beginning, south of Tokyo, on the 24th. On the 26th, its eastward movement was blocked by high pressure to the northeast. The HIGH moved east of the LOW, and the LOW moved northeastward. The RHINE MARU (41°N, 152°E) was east of the 1000-mb center (41°N, 149°E), with 40-kn southerly winds, on the 27th. The LOW tracked eastward, without particularly bothering shipping, until the 2d. At 0000, the ZEALAND VENTURE was about 230 mi southwest of the center, with 35-kn gales. On the 3d, the storm stalled near 55°N, 145°W, with a central pressure of 974 mb. During that time, 35- to 40-kn winds were the rule. On the 4th, the seas and swells rose to 20 ft, with the highest of 26 ft being reported by the ASIA BOTAN, in the southeast quadrant. Ocean Weather Station "P" measured 25 ft at 1200 (fig. 56).

On the 4th and 5th, a frontal wave moved around the southern and eastern periphery of the storm. At 1200 on the 5th, it was near the Queen Charlotte Islands with a pressure of 975 mb--13 mb deeper than

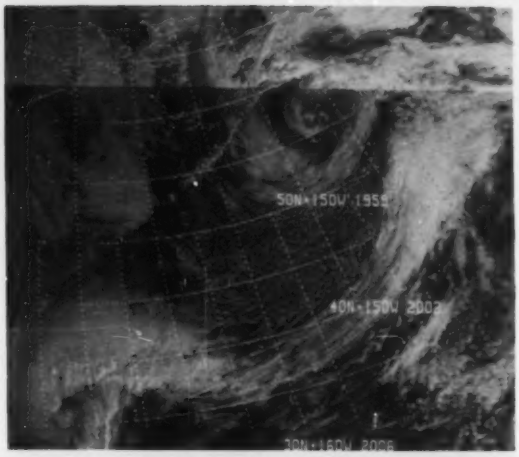


Figure 56.--With the center of the storm stationary, the cloud streets have completely encircled it, and the fronts no longer extend into the center. A frontal wave is hidden under the high cloud of the jet stream, near 48°N, 135°W.

the old LOW, which was weakening. The NEWARK, near 52°N, 132°W, was about 100 mi southwest of the center, with mild 35-kn winds and 20-ft waves. On the 6th, this LOW was the major center and rapidly weakening.

Tropical Cyclones, Eastern Pacific--Rain and an easterly wind at Acapulco, at 1200 on September 15, suggested a tropical disturbance offshore. The 1800 reports from the DEVON CITY, MARITIME ACE, and JOHAN U verified a circulation center near 16°N, 102°W, moving westward at 10 kn and forecast to be a tropical storm in 24 hr. It took only 18.

Satellite pictures included enough features to consider Lily a tropical storm, about 150 mi south of Manzanillo, by 1800 on the 16th, with winds estimated at 35 kn. Soon after forming, Lily curved slightly northwestward, slowed to about 5 kn for 30 hr, and increased in intensity to 50 kn, by 0000 on the 18th, 200 mi southwest of Manzanillo.

A west-northwesterly track continued, with no surface vessels reporting near the storm, but, at 1800 on the 18th, Socorro Island reported northeasterly winds of 30 kn, 60 to 75 mi northwest of the center. Lily was upgraded to a hurricane.

Socorro Island winds turned easterly and increased to 70 kn, at 0000 on the 19th, as Lily passed to the south and west of the island (fig. 57). The storm was then moving west-northwestward at about 12 kn.

That track continued as the hurricane slowly weakened to a tropical storm with 60-kn winds, at 1200 on the 20th, and to a tropical depression with 25-kn winds, 24 hr later, near 22.5°N, 126°W. The remains of Lily drifted west-southwestward in the northeast trades, and all traces of her were lost by the 24th.

Three tropical disturbances were indicated in satellite pictures, at 1800 September 27. They were centered near 13°N, 125°W, 11°N, 115°W, and 14°N, 106°W, and

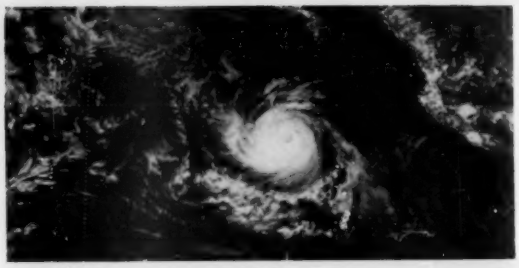


Figure 57.--Socorro Island (19°N, 111°W) was lashed by 70-kn winds, as the eye of hurricane Lily passed within 20 mi of the island.

were followed westward at 10 kn. The disturbance that was initially near 125°W dissipated by 0600 on the 28th. The IRISH MAPLE, at 11°N, 114°W, at 0000 on the 28th, reported southwesterly winds of 10 kn and, gaining slowly on the disturbance, reported southwesterly 15-kn winds about 75 mi from the center of activity, which was estimated near 12°N, 117°W, at 0600. By 1800, the IRISH MAPLE's pressure had fallen to 1007.4 mb, at a rate of 1 mb per hr, and the wind had increased to 40 kn, indicating tropical storm Monica had formed.

The storm continued westward at about 12 kn, passing near the OCEANOGRAPHER, at 0600 on the 29th. The IRISH MAPLE reported 30-kn winds about 100 mi from the center, near 12.3°N, 123°W, at 1800 on the 29th, as Monica continued to travel on a course a little north of west. The strongest wind in the storm was 45 kn, indicated by satellite pictures at 1800, near 13°N, 123°W (fig. 58).

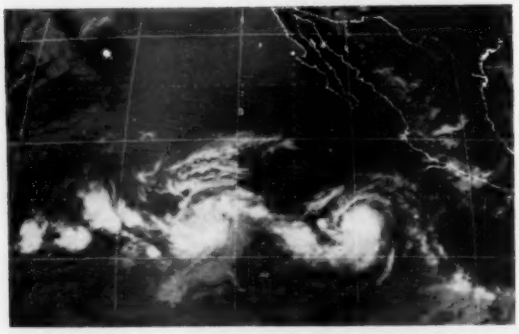


Figure 58.--Tropical storms Monica (left) and Nanette (right) were both relatively weak cyclones, with maximum winds of only 45 kn.

Monica continued westward to 13.9°N, 126.5°W, by 0600 October 1, when she was downgraded to a depression, and bulletins were discontinued. The disturbance continued westward, giving the WESER heavy rain and 20- to 25-kn winds on the 2d. After that, the remains could be seen in pictures, moving to 17°N, 140°W, by 1800 on the 6th. The KISHU MARU, NECTARINE CORE, and PHILIPPINE BEAR reported near the cloud cover, but suggested no circulation in their observations.

The eastern-most tropical depression, near 14°N, 106°W, at 1800 on September 27, was relocated farther south, as it became a tropical depression near 12.8°N, 107°W, at 1200 on the 28th. It moved generally westward at 8 to 10 kn and increased in intensity to become tropical storm Nanette, near 12.8°N, 110.1°W, slowing slightly and curving a little south of west (fig. 58).

The southern point in the track was reached, at 1200 on the 30th, near 12.2°N, 111.8°W, after which a northwesterly and westerly track at about 10 kn continued through 0600 on October 3. Gradual intensification continued to 45 kn, at 1800 October 1, and continued through 0600 on the 3d.

Weakening was as slow as the generation. Winds of 40 kn continued near the center until it reached 15°N, 122.5°W, at 0600 on the 3d, when a southwesterly track began. By 0000 on the 4th, the storm became a disturbance, near 14°N, 125°W, and bulletins were discontinued.

No vessels were near enough to the storm to report any significant weather. If it weren't for satellite pictures, it is doubtful that Nanette would have been detected.

Tropical Cyclones, Western Pacific--Typhoon Tess developed northeast of Saipan on the 2d. Moving in a northerly direction, she reached typhoon strength the following day. Tess peaked, on the 5th, as maximum winds reached 95 kn near her center, which was moving north-northwestward. At this time, tropical storm Viola was flaring up far to the southwest. Viola reached tropical storm strength, on the 6th, near 16°N, 131°E (fig. 59). She moved northeastward, but faded by the 7th. Meanwhile, Tess was swinging north-northeast-

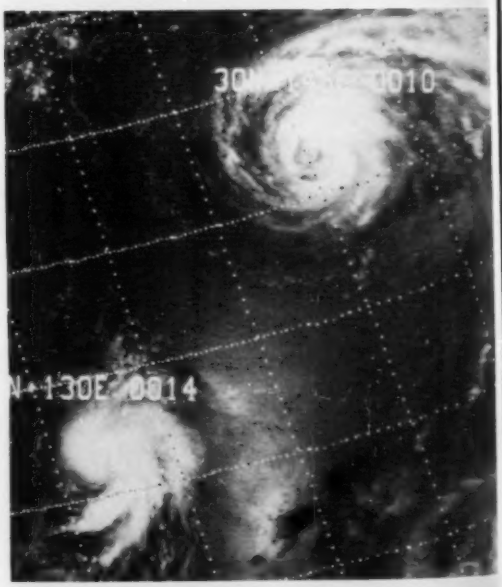


Figure 59.--Beauty (Tess) and the beast (Viola)--Tess, to the north, exhibits prize-winning typhoon form, while Viola is not so well formed.

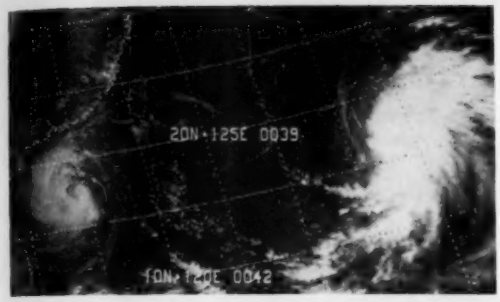


Figure 60.--Life and Death--On the 19th, Alice is coming to her journey's end, as she drops to tropical storm strength approaching Hainan, To the east, Betty is beginning to intensify to typhoon strength, on the road to Taiwan.

ward and losing strength, but not before mauling the OREGON with 65-kn winds and 20-ft seas, when she was about 60 mi east of the eye. She kept her typhoon winds until the 9th, and after she had crossed the 30th parallel. At 1200, the PLUVIUS reported 40-kn winds and 25-ft waves, 180 mi northeast of the center (35°N, 150°E). On the 10th, the KRYPTOS was hit by 55 kn, a few miles east of the 39.5°N, 152°E center. The HOYO MARU caught 50-kn winds after the extratropical center crossed the Kurils.

At this same time, typhoon Winnie was coming to life farther east, near 25°N, 164°E. Winnie moved northward and intensified. She reached typhoon strength, on the 10th, near 30°N, 163°E, while Tess was turning extratropical as she approached the 40th parallel. Winnie was just a minimal typhoon for about 1 day. By the 11th, she was a tropical storm again, heading northeastward. She eventually succumbed to the same fate as Tess.

A brief lull in activity was broken by Alice and Betty. Alice was first detected, on the 16th, near 14°N, 130°E, while Betty came along a day later, near 17°N, 142°E. Both moved on a general west-northwesterly course. On the 17th, Alice, nearing the Luzon coast, became a typhoon. Winds climbed to 75 kn near her center, which drove ashore later that same day. Betty was still developing and meandering westward at this time. Alice remained intact as she crossed Luzon and headed across the South China Sea. However, she fell to tropical storm strength, by the 19th (fig. 60), before limping across Hainan. Meanwhile, Betty had turned northwestward and was coming to life. She reached typhoon strength, on the 21st, near 21°N, 131°E, heading west-northwestward toward Taiwan. Winds near her center climbed to about 100 kn before Betty barged across southern Taiwan on the 22d. She moved through the Formosa Strait and over mainland China the following day. During the typhoon, the 8,082-ton Panamanian freighter MILAN was flooded to a depth of 23 ft in her engineroom, when hit by the motorvessel EAST UNION.

Casualties--The Liberian-registered OSWEGO COURAGE requested a survey at Singapore, on the 8th, of a bulkhead fracture caused by heavy weather. The barge FLASH I, in tow of the tug RIVER EARN, from Chittagong to Kyauk Pyu, Burma, broke adrift, on the 9th, in the Bay of Bengal.

Marine Weather Diary

NORTH ATLANTIC, DECEMBER

WEATHER. December is generally one of the stormiest months of the year over the North Atlantic, particularly north of 35°N. Deep and extensive LOWs traverse the middle and northern shipping lanes, producing strong winds and high seas. Extended periods of rain, sleet, or snow usually attend these storms. A comparison with the normal pressure pattern of the preceding month shows that in December the Azores High remains at about 1021 mb and is centered near 35°N, 33°W. The Icelandic Low deepens 1 mb to 1001 mb; it is located near 62°N, 38°W.

WINDS from the westerly quarter prevail over most of the ocean north of 40°N. Speeds average force 5 to 6 over most western and central waters, and about force 4 over the Bay of Biscay and surrounding waters, the Baltic Sea, and the southern portion of the North Sea. Force 5 to 6 southeasterlies prevail over the northern half of the North Sea, while southerlies of force 4 to 5 are predominant off the central coast of Norway. Winds over the Norwegian Sea are variable at about force 5. Between 40° and 30°N, winds (force 3 to 4) are westerly or southwesterly west of 20°W, northerly or northeasterly between 20°W and the Strait of Gibraltar, and predominantly westerly over the Mediterranean Sea. The "northeast trades," also averaging force 3 to 4, persist between 30° and 10°N, except off the east coast of Florida where winds are variable at force 4. As in November, force 3 southeasterlies prevail over the extreme southern North Atlantic.

GALES. The occurrence of gales is more frequent over northern and middle latitudes than in November. Winds of force 8 or higher occur 10 percent or more of the time from about 34°N over the western North Atlantic to about 40°N over eastern waters. A 10-percent frequency of gales is encountered on the Mediterranean Sea within an area extending nearly 200 mi southeastward from the Gulf of Lions. The incidence of gales is less than 10 percent over the immediate waters east of Newfoundland and over the

Davis Strait. Areas of maximum gale frequency--20 percent or higher--are found within an area from the Labrador Sea southeastward to about 44°N, 35°W, then north-northwestward to 56°N, 40°W, then eastward to 55°N, 24°W, then north-northwestward again to the cold waters off southeast Greenland; over much of the Norwegian Sea; and over the Gulf of Lions.

EXTRATROPICAL STORMS. Two primary storm tracks--one from the waters east of the United States Middle Atlantic States and one from the northern Great Lakes--converge over Newfoundland and then head toward Greenland, where they split into two tracks with one leading into the Davis Strait and the other heading toward Iceland. A large number of LOWs also head toward Iceland from the central ocean east of 40°W and north of 50°N. Another cyclone track enters the Davis Strait from Hudson Bay, while still another runs across the northern coast of Norway from the Norwegian Sea. A primary track stretching from the Gulf of Lions to west-central Italy and then east-southeastward to the south coast of Turkey influences the Mediterranean area. The Great Lakes have their highest cyclone frequency of the year during December. The frequency of cyclogenesis over the Gulf of Mexico also reaches it annual maximum during December.

TROPICAL CYCLONES. There is seldom a tropical storm on the North Atlantic in December. During the 43-yr period, 1931-73, only two were recorded; one of these reached hurricane strength.

SEA HEIGHTS of 12 ft or higher occur 10 percent or more of the time north of a line extending from the northwest coast of Spain to approximately 35°N, 70°W, and then east of a line joining that point with Nova Scotia. On the Norwegian Sea, however, sea heights $\geq$ 12 ft usually occur less than 10 percent of the time. Ten-percent frequencies are also found in the Mediterranean between Balearic Islands, Sardinia, Tunisia, and the French Riviera; between Sicily and Crete; and on the northern Aegean Sea. Maximum frequencies of 30 percent or more occur over the Denmark Strait and over much of the western and central ocean north of about 47°N and south of the 60th parallel. An isolated area of 20-percent frequency rests over the Gulf of Lions.

VISIBILITY. The frequency of visibility less than 2 mi climbs to 10 percent over the Labrador Sea, over a pocket-shaped area extending from Kap Farvel south-southwestward to the Grand Banks, over the southern and eastern Davis Strait, and over the southern North Sea. Frequencies of this low visibility are also greater than 10 percent over the area north of a line drawn from the Denmark Strait eastward across northern Iceland, then dipping southward to about 64°N, 7°W, then stretching north-northeastward over the Norwegian Sea, and then eastward to the northern coast of Norway. North of about 72°N, the frequency of visibility less than 2 mi increases to 20 percent and continues to increase as one moves eastward until, after reaching the southern Barents Sea north of the Soviet Union, frequencies reach a maximum of 40 to 50 percent.

NORTH PACIFIC, DECEMBER

WEATHER. December is usually a stormy month over North Pacific waters, particularly in the northern and middle latitudes. The normal pressure distribution is quite similar to that of the preceding month with the Aleutian Low (1001 mb) shifting to near southeastern Kamchatka.

WINDS north of 55°N blow mostly from a northerly direction at force 4 to 6, except over the Gulf of Alaska where force 4 easterlies prevail. Westerly winds of force 3 to 6 are usually felt south of 55°N to about 40°N over the extreme eastern ocean, 35°N over the central-eastern and midocean, and 30°N west of 165°E and east of Japan. Nevertheless, winds over the southwestern Bering Sea show a tendency to be variable, and off the coast of British Columbia the prevailing wind is southerly. Steady "northeast trades" prevail (force 4) between 25°N and the Equator, except they extend to nearly 35°N off the southwestern California coast. These trade winds merge with the force 4 to 5 winds of the northeast winter monsoon near 140°E. Variable winds (force 3 to 4) lie in a narrow belt between the aforementioned westerlies and northeasterlies. Prevailing winds are largely from the north or northwest and average about force 4 over the Sea of Japan, and the Yellow Sea, and along the southeast coast of Japan. Northerly winds blow steadily out from the Gulf of Tehuantepec, off the south coast of Mexico.

GALES. A larger area of the North Pacific is subject to gales during December than in the preceding month. North of about 39°N over eastern and central waters and 32°N over western waters, 10 percent of the observations contain winds of force 8 or higher. The greatest frequencies, 20 to about 25 percent, occur in three scattered areas from the waters south of the southern tip of the Kamchatka Peninsula south-southeastward to about 34°N, 166°E. Farther north, the frequency of gales decreases to less than 10 percent over the Sea of Okhotsk and the Bering Sea. They are also under 10 percent across a triangularly shaped area southeast of the Aleutians bounded at 53°N, 162°W; 47°N, 163°W; and 49°N, 174°W. Gales are recorded between 5 and 10 percent of the time on the waters surrounding Taiwan, the southern Ryukyus, and the northern portion of Luzon as far east as 144°E, because of the strong development of the northeast monsoon. Gale-force northerly winds occur between 5 and 10 percent of the time out from the Gulf of Tehuantepec.

EXTRATROPICAL CYCLONES. Primary storm tracks extend from the northern portion of the Sea of Japan and the waters east of the Ryukyus to the ocean region lying between Kamchatka and the western Aleutians. From there, LOWs either pass near the Pribilof Islands or continue east-northeastward to the Gulf of Alaska. Another major storm track reaches the Gulf of Alaska from an area south of the Alaska Peninsula near 48°N. The only other primary cyclone track swings toward Vancouver Island from a point 450 mi west of the Oregon coast.

TROPICAL CYCLONES. One tropical storm usually develops over the western North Pacific during December. About two out of every three that do pop up go on to become typhoons. The most likely area of formation is in the neighborhood of the Caroline Islands. Contrary to the events of November, very few of these storms are able to maintain their identity over the South China Sea after traversing the Philippines.

Off the Mexican west coast, tropical cyclones are rare in December.

SEA HEIGHTS of at least 12 ft occur 10 percent or more of the time north of approximately 35°N, east of 150°E, and south of the Alaska mainland, the Aleutian Islands, Kamchatka, and 55°N on the Sea of Okhotsk.

VISIBILITY under 2 mi occurs 10 percent or more of the time north of a line drawn from the lower Tatar Strait to the central Kurils and then northeastward to the western Aleutians where it dips southeastward to about 47°N, 177°W. Upon reaching a point near 47°N, 165°W, the line bends generally northward to Cape Romanzof, Alaska. A much smaller area of 10-percent frequency is centered near 44°N, 143°W. Visibility less than 2 mi encompasses more than 20 percent of all observations poleward of a line cutting through the northern and eastern portions of the Sea of Okhotsk, the northern Kurils, and then northeastward through the Bering Sea to the Bering Strait (passing west of both the Komandorskiye Islands and St. Lawrence Island). A smaller area comprising a 20 percent or greater frequency lies north of the central Aleutians near 54°N, 173°W.

NORTH ATLANTIC, JANUARY

WEATHER. January is generally characterized by rough weather over the middle and northern latitudes of the North Atlantic. LOWs frequently become deep, and associated winds often reach gale and sometimes hurricane force. The Icelandic Low (1000 mb), centered off the extreme southeastern tip of Greenland, is deeper than at any other time of the year. The Azores-Bermuda High with a central pressure of about 1023 mb covers a band from the western Mediterranean Sea west-southwestward to the waters northeast of the Bahamas.

WINDS. North of 40°N, the prevailing winds are westerly over most of the ocean. Over the Norwegian Sea and the North Sea, winds from the southerly quarter prevail. The average wind speeds are predominantly force 4 to 6, except up to 1,200 mi south and east of the southern tip of Greenland and over the Labrador Sea where they reach force 5 to 7. Between 25° and 40°N, the wind direction is from the southwest quarter of the compass over the main body of that portion of the Atlantic, mostly easterly over the Gulf of Mexico, variable over the waters east of Florida, and northerly or northeasterly from west of the Iberian Peninsula to the Canary Islands. Westerlies still dominate over the Mediterranean Sea. Force 3 to 4 winds are the most common except off the coast of the middle Atlantic United States where force 4 to 6 winds prevail. From the Equator to 25°N, the "northeast trades" persist; more than 65 percent of the time wind speeds range from force 3 to 5, except south of 10°N where these winds blow more than 50 percent of the time.

GALES (winds force 8 and higher) occur in 10 percent or more of the observations north of 35°N over the western part of the ocean and north of 40°N over the eastern part. The Mediterranean Sea hosts 10-percent frequencies out to 150 mi from the Gulf of Lions, over the northern Adriatic Sea, and over most of the Aegean Sea. The highest frequency over all North Atlantic waters, 30 percent, is found over a small area centered at about 58°N, 30°W, over a narrow belt off the southern tip of Greenland between 38° and 52°W, and (because of the mistral) over the Gulf of Lions.

EXTRATROPICAL CYCLONES. During the winter months (December, January, and February) LOWs form most frequently in a band 150 to 250 mi wide stretching from the North Carolina-South Carolina border northeastward to about the latitude of Cape Cod. This is part of a large area of cyclogenesis that extends from the Gulf coast of the United States northeastward to the Bay of Fundy. Other principal areas of cyclogenesis lie over the western half of the central ocean between Newfoundland and the British Isles, over most Icelandic coastal waters, over the inland waters east of the North Sea except the Gulf of Bothnia, and over the Mediterranean from the Gulf of Lions southeastward to the toe of Italy and then northward to the Yugoslavia coast. Cyclogenesis is more concentrated around the waters on both sides of central Italy than anywhere on the North Atlantic during winter with the exception of the band off the United States Atlantic coast. In January, primary storm tracks run from the Carolina capes to Cape Race and from Lake Superior to Cape Bauld. After reaching Newfoundland, cyclones either head northward to the Davis Strait or the Denmark Strait or northeastward to Iceland. Primary storm tracks are also present off the northern Norwegian coast, over the Mediterranean from the Gulf of Genoa to Cyprus, and over the eastern Great Lakes where they join the track toward Newfoundland.

SEA HEIGHTS greater than 12 ft occur 10 percent or more of the time north of 33°N over the western North Atlantic and north of 42°N over eastern waters. Frequencies greater than 10 percent also exist in a small area near Barranquilla, Colombia, and on the Mediterranean between Menorca and Sicily (not including the waters surrounding Corsica), south of Greece and west of Crete, and on the northern Aegean Sea. A large area of frequencies greater than 30 percent stretches from south of Iceland to west of Ireland to east of the Grand Banks and then northward to the waters southwest of Greenland and south of the waters between Greenland and Iceland. Smaller areas of similar frequency are found on the Denmark Strait and west of northern Norway near 67°N, 10°E. The frequency of sea heights greater than or equal to 12 ft decreases to less than 10 percent over a large portion of the Norwegian Sea north of 67°N between 5°E and about 13°W.

VISIBILITY less than 2 mi is noted in more than 10 percent of the observations from Cape Sable eastward to the Grand Banks and northward to Cape Mercy, over the Denmark Strait and the northwestern portion of the Norwegian Sea, and over the southern portion of the North Sea. The frequency increases to more than 20 percent in the Resolution Island area and over the Norwegian Sea north of about 70°N.

NORTH PACIFIC, JANUARY

WEATHER. The most severe weather of the year occurs generally in January over the middle and northern latitudes of the North Pacific. The circulation over the ocean is controlled mainly by the major centers of action--the Aleutian Low, the subtropical High, and the Siberian High. All except the subtropical High are near or at their peak seasonal development. The Aleutian Low, with a central pressure of 1000 mb, is southeast of Kamchatka near 50°N, 165°E, while the axis of the Pacific subtropical ridge exceeds 1021 mb from about 30°N, 135°W, east-northeastward to the State of Wyoming. The wind regime near the Asiatic coast from the Korea Peninsula to the South China Sea is controlled principally by the clockwise flow around the Siberian High (1036 mb), situated over Asia near 49°N, 96°E.

WINDS. Westerly winds prevail over much of the ocean north of 30°N and west of 180°. Northerly winds dominate the East China Sea. Winds are variable over the western Aleutians, southeasterly over the central Aleutians, and northeasterly near the Pribilof Islands. From the Gulf of Alaska southward to near 40°N and east of 180°, winds are mostly westerly to southerly, although other directions are common during the frequent passage of LOWs. Over the extreme northern Gulf of Alaska, the prevailing winds are easterly, and northerly winds are very pronounced over the Bering Sea north of 60°N. The average speed of winds north of 30°N is force 4 to 6, although southeast of Kamchatka the wind blows at force 7, 21 percent of the time. The "northeast trades" extend northward to near 25°N over most of the western and central ocean and to 30°N over eastern waters; south of 20°N, these winds are very steady. The wind speeds in the trades range from force 3 to 5. The "northeast monsoon" is steady over the South China Sea and the Philippine Sea south of 30°N and west of 150°E. Winds are quite variable over the eastern North Pacific between 30° and 40°N, southwesterly over the east-central ocean between 25° and 40°N, and variable over west-central waters between 25° and 30°N and 150°E and 180°. Wind speeds over the above three areas are usually force 4. Northerly winds predominate over the Gulf of Tehuantepec, and in 65 percent of the observations they range between force 2 and 6.

GALES. The frequency of gales near and above 10 percent affects most noncoastal areas south of the Aleutians and north of a line from the waters southeast of Honshu to a point south of the Queen Charlotte Islands and west of Washington State. A maximum incidence of over 20 percent is found over a relatively large region southeast of Kamchatka, over a smaller area east of northern Honshu near 39°N, 154°E, and south of the Gulf of Alaska near 50°N, 145°W. Gale-force northerly winds are encountered more than 10 percent of the time by vessels plying the Gulf of Tehuantepec off southern Mexico. These violent squally winds occur when strong northers from the Gulf of Mexico funnel across the isthmus to the Pacific. In extreme cases, they may be felt more than 200 mi out at sea.

EXTRATROPICAL CYCLONES. Principal areas of cyclogenesis during winter are found from Taiwan on the southwest to the northern Kurils and lower Sakhalin on the northeast and from just north of Marcus Island on the southeast to the western shore of the Sea of Japan on the northwest. The Yellow Sea and Korean coastal waters are not included in this vast region of cyclogenesis. Other smaller areas of cyclogenesis lie over the Pribilof Islands, the Gulf of Alaska, off the North American coast from the Queen Charlotte Islands southward to northern California, and over the east-central ocean about midway between the Aleutian and the Hawaiian Islands. The migratory LOWs move mostly northeastward from the East China Sea and Hokkaido to the western Aleutians and then eastnortheastward to the Gulf of Alaska. Other primary tracks approach the Gulf of Alaska and Vancouver Island from the southwest.

TROPICAL STORMS are infrequent in January. On the average, two can be expected every 5 yr over the western North Pacific. Most of these storms develop between 6° and 10°N and west of 150°E and move toward the southern half of the Philippines. Three out of every five January tropical storms achieve typhoon strength.

SEA HEIGHTS greater than 12 ft occur more than 10 percent of the time in an area extending northward from 30° to 35°N to a line drawn from Kodiak Island to the central Aleutians and then to the southeastern waters of the Sea of Okhotsk, and westward from a line 700 mi off the coast of southeastern Alaska and 500 mi off the Oregon coast to 150°E.

VISIBILITY less than 2 mi occurs in 10 percent or more of the observations over an area of the eastern North Pacific between 40° and 50°N and 141° and 162°W, and northwest of a line drawn from Hokkaido to the western Aleutians and then northeastward along the Aleutian chain to the Alaska Peninsula and Cape Avinof. A maximum frequency of over 30 percent encloses a small area over the Okhotsk Basin southwest of Kamchatka.

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